AUGUST 1953

PRECISION METAL MOLDING

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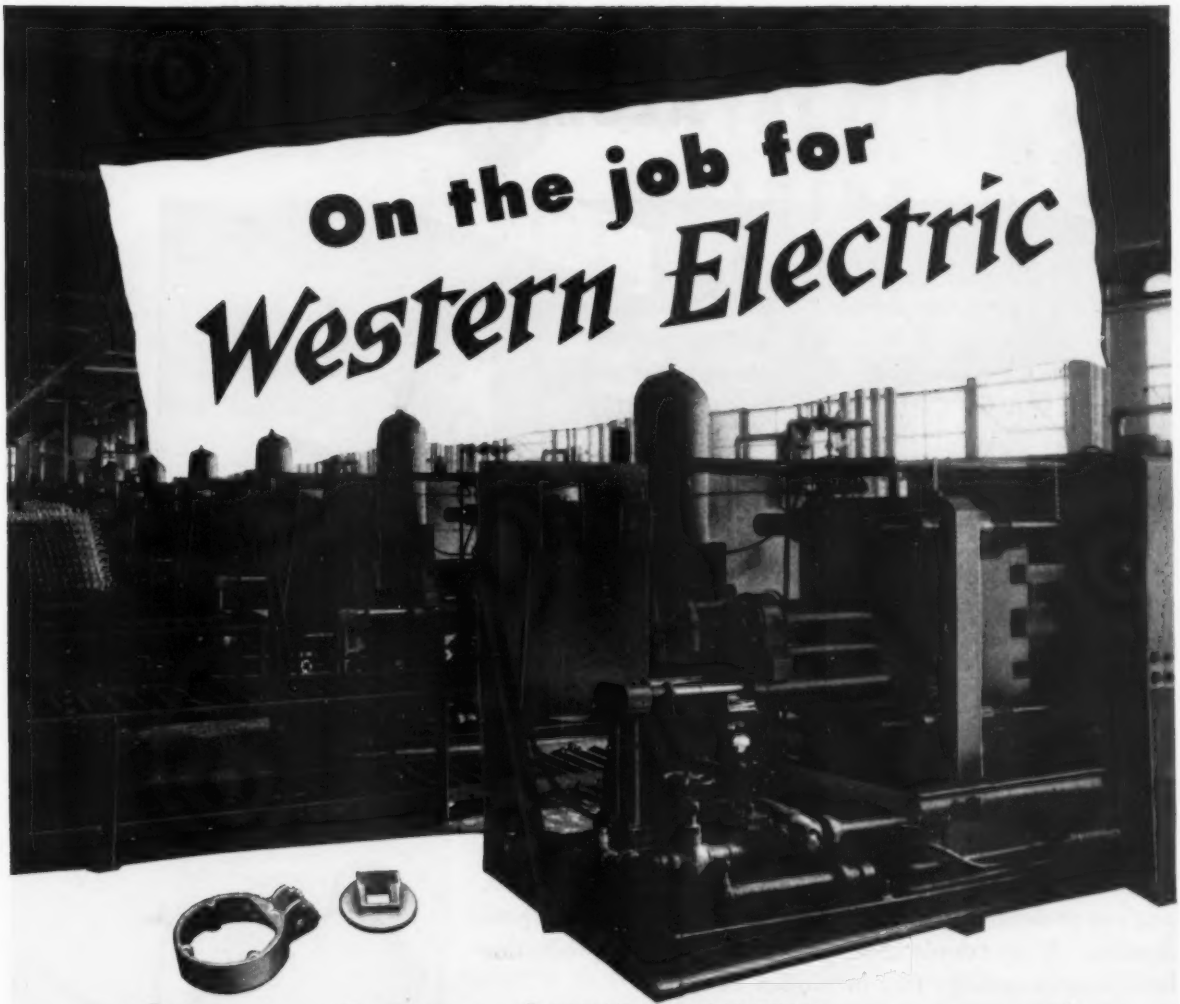
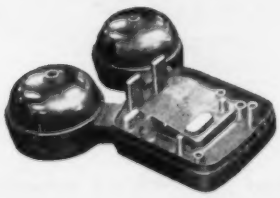


TYPICAL DIE-CASTINGS PRODUCED BY WESTERN ELECTRIC ON CAST-MASTER MACHINES.



Battery of CAST-MASTERS now operating for the world's largest manufacturer of telephone equipment • • • • • • •

Cast-Master is proud of the part its machines play in the die-casting operations of Western Electric Co. As the world's largest manufacturer of telephone equipment, Western Electric requires huge production runs, and demands the highest standards of speed and accuracy from its machines.

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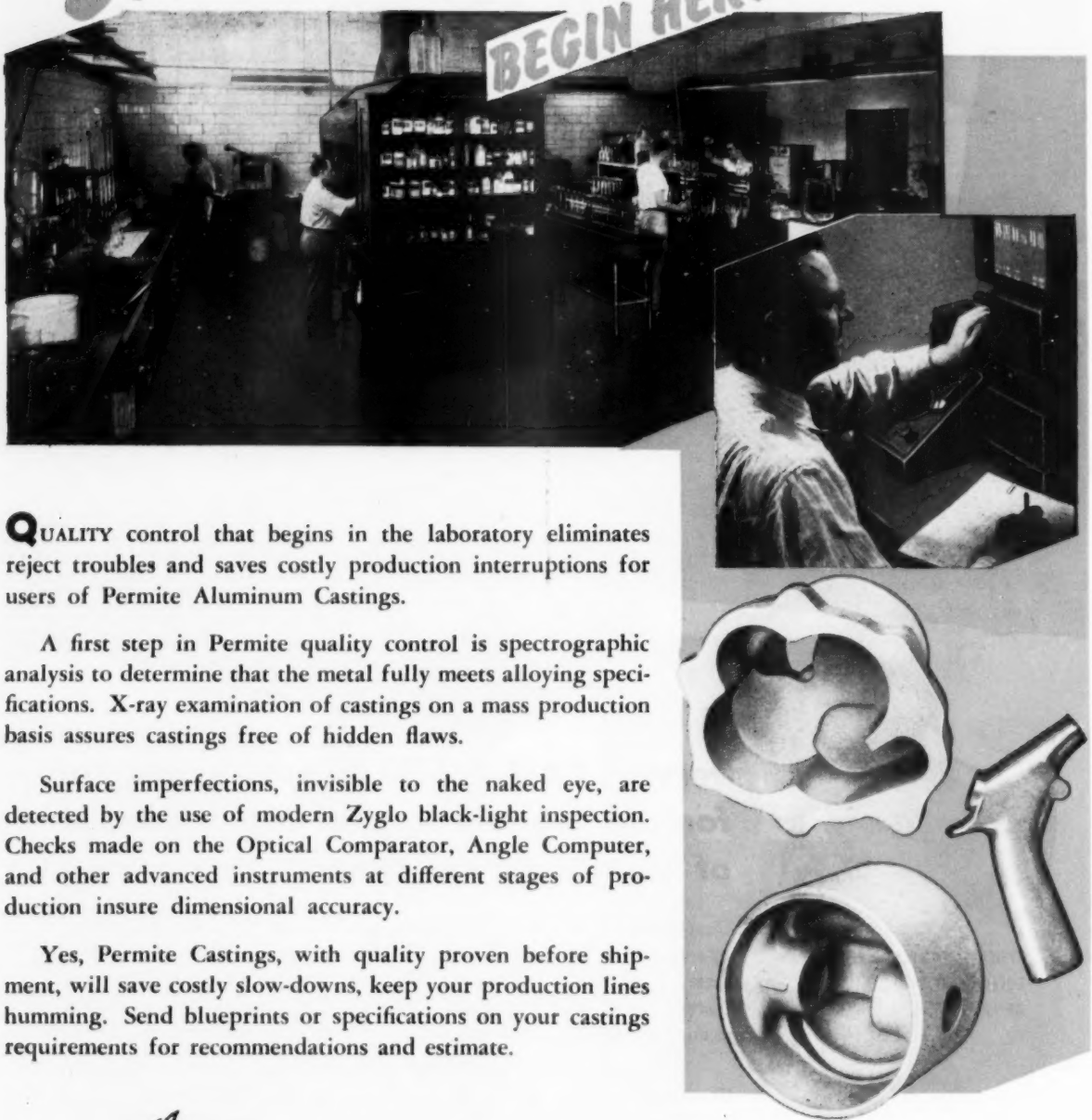

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ALUMINUM PERMANENT MOLD and SAND CASTINGS . . . HARDENED, GROUND and FORGED STEEL PARTS

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AUGUST 1953
Vol. 11 No. 8

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PRECISION METAL MOLDING

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CONTENTS

LETTERS TO THE EDITOR 6

BETWEEN THE LINES 8

LONGER SERVICE LIFE obtained from powdered metal parts 27

COMBINE AND ELIMINATE:
the key to economical use of die castings 28

HIGH FREQUENCY CORES: an important use for powdered iron 30

IS A BRONZE FORGING NECESSARY? 34

FLATNESS AND DIMENSION are held in these shell mold castings 37

Permanent mold castings on the outside
give MORE WORK SPACE INSIDE 38

THE CAM'S THE THING —
pressed from iron powder and infiltrated with brass 40

LEAD DIE CASTING: case history of a part that was "impossible"
by any other method 42

INDEXING FROM CORED HOLES simplifies alignment 44

OPPORTUNITIES 70

SIMPLIFIED SOLUTIONS for production problems 73

INDUSTRY NEWS 81

FINISHING SECTION

How to use STEEL BALL AND SHAPES for barrel finishing 46

How to get MORE CUTTING ACTION from diamond wheels 53

USEFUL LITERATURE 55

NEW PRODUCTS 58

REFERENCE MATERIAL in this month's ads 63

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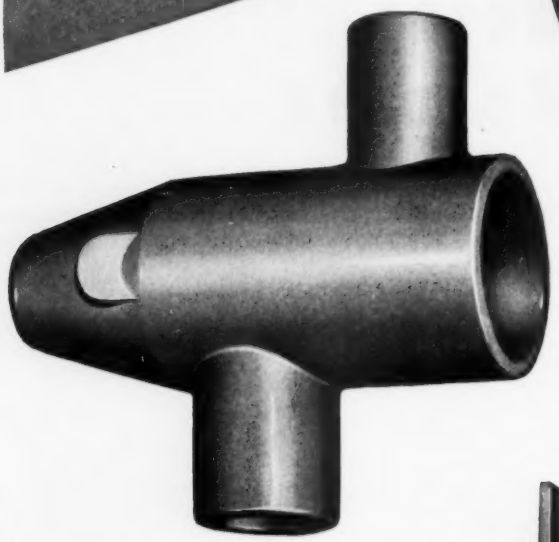
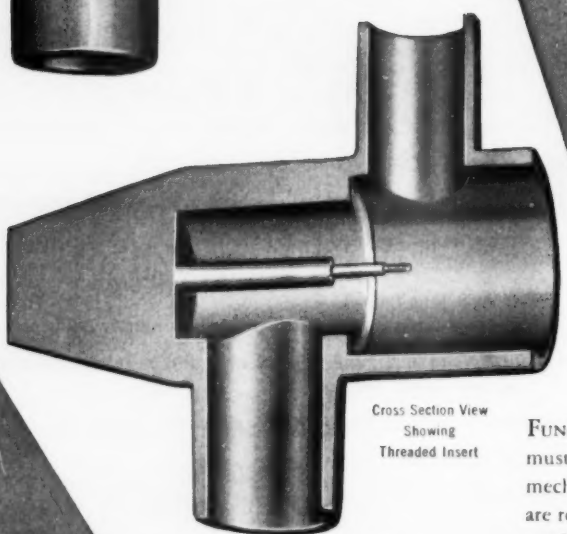
for the DENTAL EQUIPMENT FIELD with MADISON-KIPP ZINC and ALUMINUM DIE CASTINGS





Cross Section View Showing Threaded Insert

Madison-Kipp aluminum die castings made for the Ohio Chemical & Surgical Equipment Co., a Division of Air Reduction Company, Incorporated, for their New Ohio Dental Analgesia Unit for administering TRIMAR.

FUNCTIONAL COMPONENTS of dental equipment must be made with the greatest care known to the mechanical industries. Highest quality die castings are required and that is why Madison-Kipp products are often specified as in the case of the Non-rebreathing Valve and Vaporizer support here illustrated. Madison-Kipp is skilled and seasoned in die casting mechanics and invites your inquiries for co-operative effort.

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• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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A 650-TON SQUEEZE...

MAKES MOLTEN METALS BEHAVE!

POWERFUL TWO-STAGE INJECTION SYSTEM AND EXCLUSIVE NEW "HYDRA-LOCK" CLAMP are featured by the LEWIS die-forge casting machine. This machine brings new concepts of quality, economy and safety to the die casting industry. It is designed to mass produce, with minimum scrap, high-strength, low-cost aluminum and magnesium alloy parts weighing up to 9.5 pounds.

The high-speed hydraulic injection system fills the dies rapidly and then compresses the molten metal with final squeeze pressures up to 100,000 pounds. These tremendous pressures are possible because of the LEWIS "HYDRA-LOCK" mechanism, which exerts a 650-ton hydraulic clamping pressure to keep dies closed and prevent "spitting". Both injection speed and final squeeze pressure are variable to meet individual job requirements.

"HYDRA-LOCK" also permits quicker, easier die setting. Its design gives the moving die-plate a ball-and-socket action that compensates for misalignment of die faces within reasonably close limits.

For efficient . . . low cost . . . safe production of superior die castings, specify the LEWIS machine. It has no equal for quality or economy.

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LETTERS TO THE EDITOR

MPA MEMBERSHIP

I have become increasingly interested in Powder Metallurgy since reading your Precision Metal Molding Magazine.

I would like to become a member of the M. P. A. and will greatly appreciate any information you could give me as to how to make this possible. — E. S. (Metallurgical Dept.)

We have referred this request directly to Robert Ziegfield, secretary of the Metal Powder Association, whose offices are located at 420 Lexington Ave., New York 17, N. Y. — Ed.

TEMPERATURE CONTROL

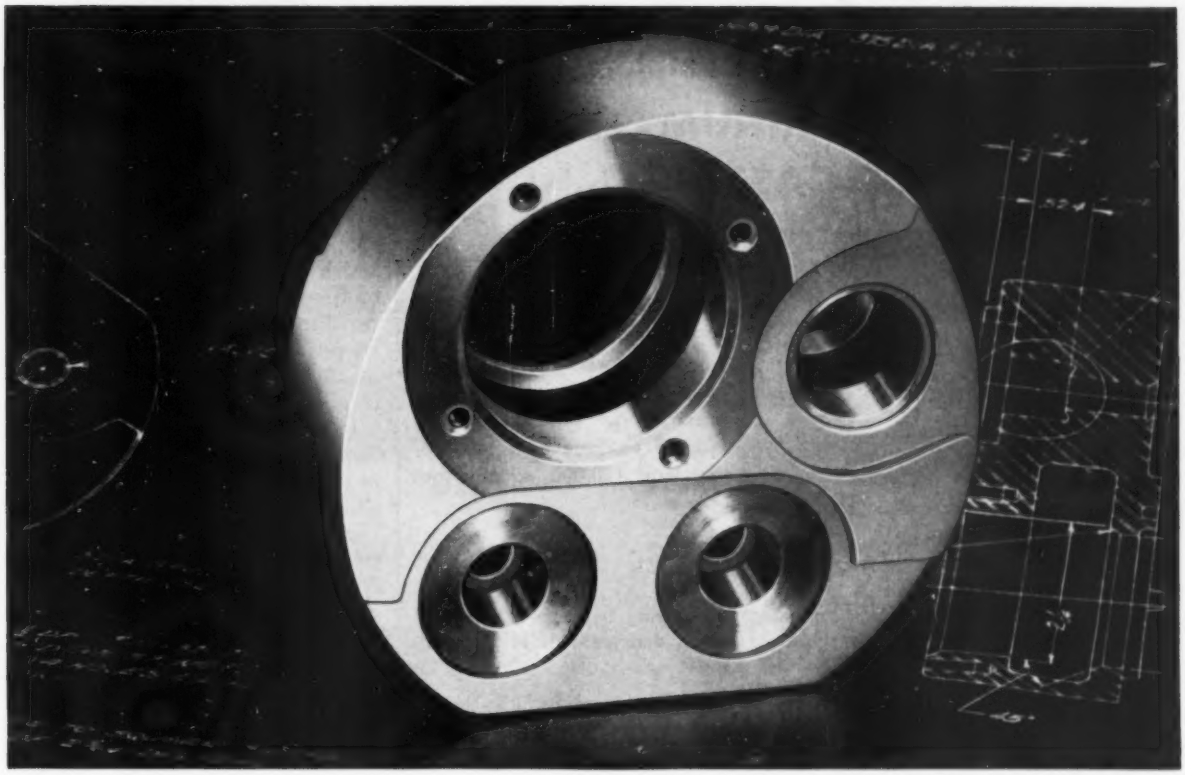
In your July issue is an article on slush castings in which there is mentioned that the temperature of the melt is carefully controlled.

We produce zinc castings for casket hardware and heretofore we have not carefully controlled the temperature of the metal in the pots. Since we are not familiar with a method for controlling the temperature in the pots, may we ask that you advise us as to the source where this information can be obtained. — R. J. S.

Method of control will, of course, depend on how your pots are heated. In the case of electrically heated pots an immersion type thermocouple with a very inexpensive barometer and off-on control will give you temperature in the pot that should not vary more than ± 5 degrees Centigrade. In the case of gas fired pots the control is generally by modulating the gas or air valve. This can roughly be done manually and then converted to an automatic controller.

Names of sources have been forwarded. — Ed.

Only *MERCASTING** can make this as a unit!



*FROZEN MERCURY INVESTMENT CASTING

PROBLEM:

Three expensive machined parts were formerly required to get the necessary internal cavities for this valve body. Use on an electronic tube evacuator made special tolerances necessary. After assembly by welding, re-machining, and testing, a large part of the total production was rejected for failure to meet the rigid specifications of the manufacturer—Distillation Products Industries, Division of Eastman Kodak Company, well-known producer of high-vacuum equipment.

SOLUTION:

DPI brought the problem to Alloy Precision Castings Company. Cooperating Alloy foundry engineers and metallurgists developed the pictured one-piece, 5½-lb. mercasting of 303 stainless. The "as-cast" piece can be held to an average plus or minus .003 inch per inch on certain critical dimensions. A comparatively small amount of finish machining is needed on valve seats and tapped holes. A-6295

SUMMARY:

The illustrated mercasting is a better valve body easily produced in a more desirable material. Tremendous savings are effected through elimination or drastic reduction of special tooling, machining, waste material, and scrapped production.

Send prints of your problem parts today. Learn how Alloy Precision can save you time and money.

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45th and Hamilton, Cleveland 14, Ohio

Please RUSH Bulletin 706 describing the Mercasting Process.

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COMPANY _____

ADDRESS _____

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ZONE _____ STATE _____

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Action with Accuracy!

--From Start to Finish

Our Facilities Are Complete For

ZINC - ALUMINUM - LEAD DIE CASTING

Here—at ***FORT DIE CASTING,*** production of quality die castings, at lowest cost, is made possible through the completeness of our organization and superb equipment, in our fully modern 100,000 square foot plant.

ENGINEERING: We maintain a competent Engineering Department to assure good casting design, the proper types of metals and methods to be used, and for close co-operation with our clients.

TOOL and DIE: We maintain complete tool and die making facilities. In this department, staffed by skilled technicians, we are equipped to completely tool up for your program and manufacture the dies to meet your specifications.

DIE CASTING: We maintain large batteries of modern die casting machines to meet all size requirements, plus special machines for die casting aluminum and lead. Expert metallurgical control is assured for the proper choice of alloys.

MACHINING: We maintain an unusually complete Machining Department. For these important and cost-saving operations, we design and manufacture new labor-saving jigs and fixtures for use in our large batteries of presses and other machining equipment, and when necessary, we design and build special purpose machines.

PLATING and FINISHING: We maintain complete facilities for mechanical finishes such as, burnishing, buffing and polishing; plating and finishing processes such as, chemical treatments, electrolytic coatings and painting.

Yes—you'll get ***Action*** with ***Accuracy,*** from ***Start*** to ***Finish*** at ***FORT***—and insure the proper and most economical production for your die cast products. We invite your inquiries.

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Between the Lines

in this and future issues of PMM

—— THERE ARE as many variations in barrel finishing techniques as there are parts to be finished. Weight, size, shape, material and required finish all influence the barrel method. In one type of barrel finishing, steel balls or metal shapes are used in the barrel in place of mineral chips. How this is done, how to select the proper shape, and how to take care of materials, are covered in a feature beginning on page 46.

—— FIVE PERCENT MORE DENSE! When you cast gray iron in a steel mold, it emerges with a very fine grain structure that is 5 to 6 percent more dense than when cast in sand molds. Product designers can make use of this property for hydraulic components and other leak-proof castings.

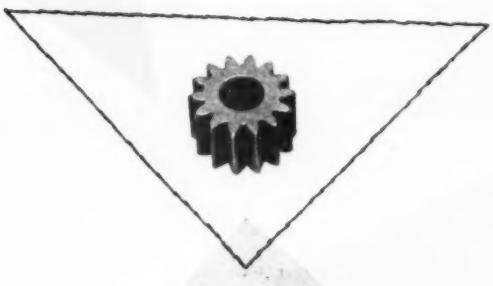
An article pointing out how this can be used will be featured in our September issue.

—— SPEAKING OF DENSITY . . . the normal powdered metal part has a moderate density with physical characteristics to match. Many designers have hesitated to use these parts where higher stresses are involved. Gradually the powder metallurgy industry is finding ways to produce parts having higher densities and, consequently, higher physicals. A few such parts will be presented in the September issue.

—— DIE CAST LEAD offers some very specific and unique advantages. The range of alloys is almost unlimited . . . a special alloy for just about every purpose. PMM has a couple of special articles, one on the engineering properties of lead-tin alloy die castings,

continued on page 14

our knowledge began several billion parts ago!



METAL POWDER PARTS BY MORAINE

m

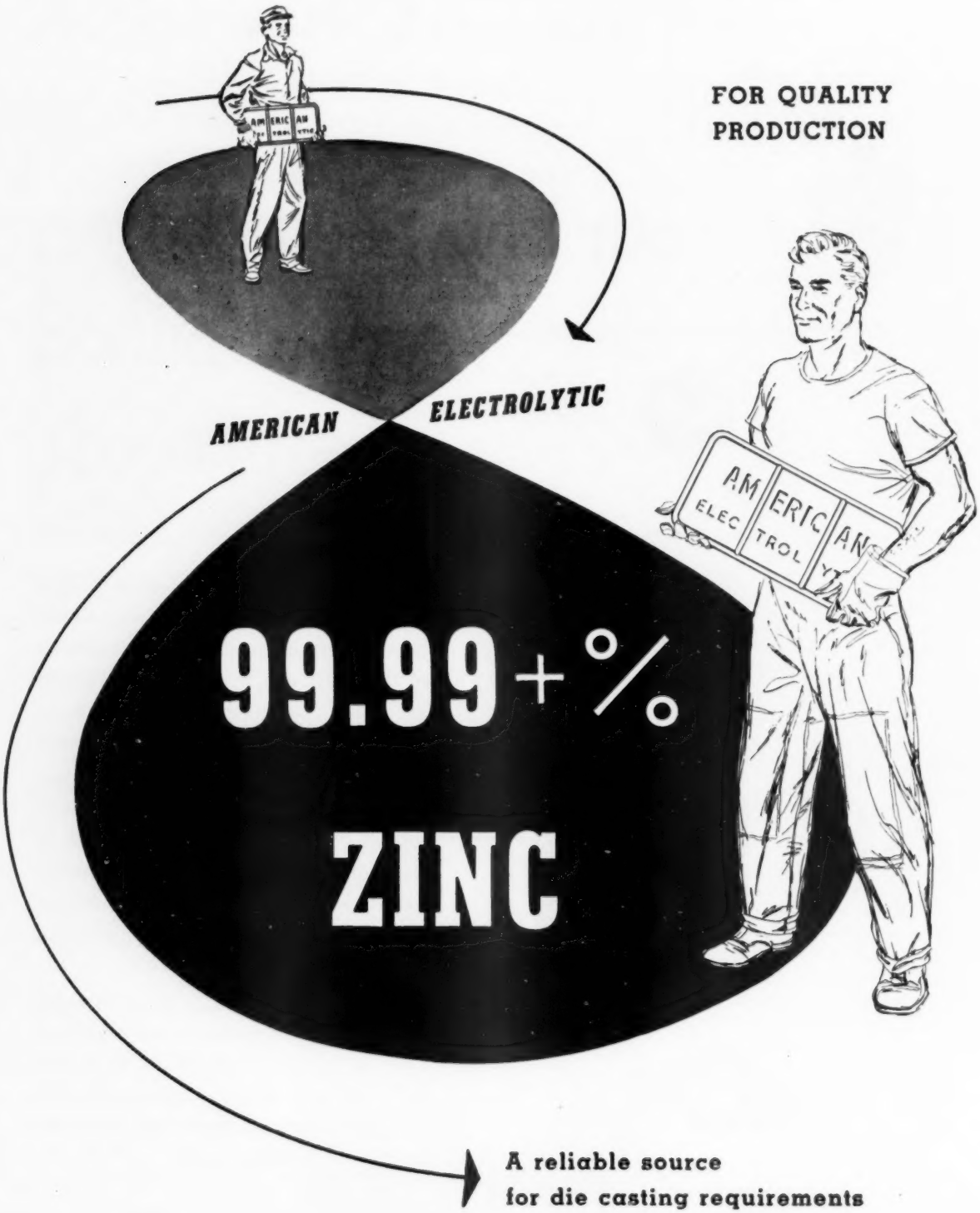
Thirty-two years and several billion parts ago we began learning about powder metallurgy. Our knowledge of this business is now considerable, yet even today there's no end in sight to what can still be learned.

Applying our always-growing knowledge enables us to find new ways to improve the physical properties of our metal powder products; to offer an ever-broadening range of materials to our customers; to make possible more and more applications.

Our position in the field of powder metallurgy is a proud one . . . but we take a greater pride in the fact that our products are providing industry with a means of improving performance while cutting costs.

moraine products

DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO



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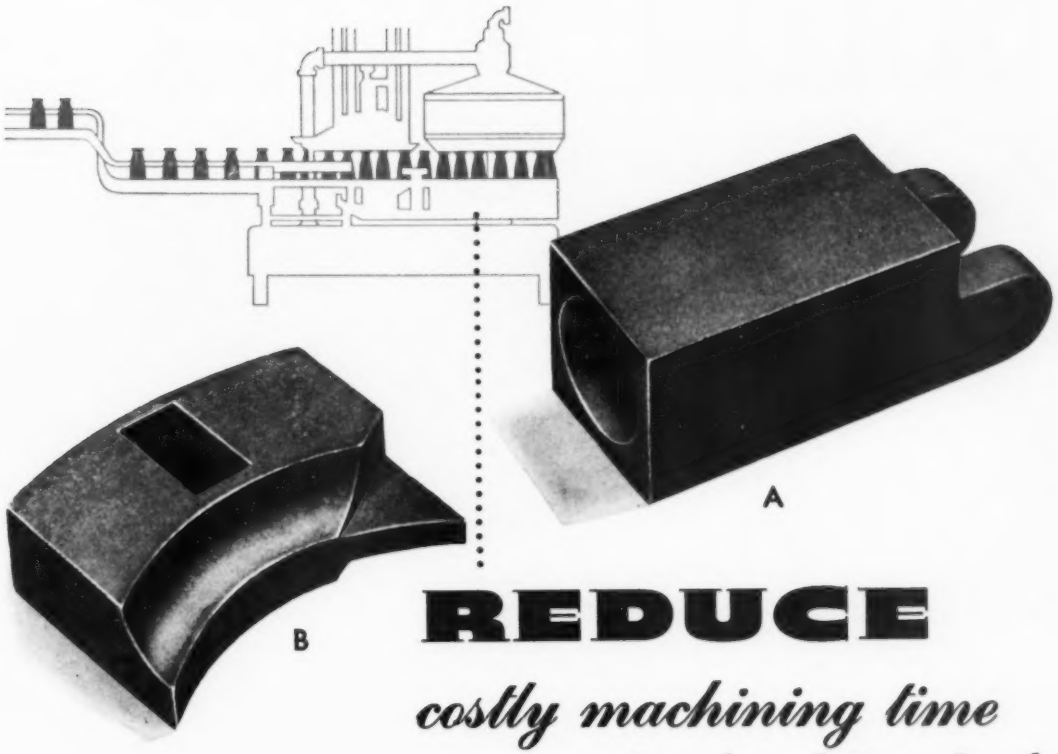

REDUCE

costly machining time and extend product life

C

with Crucible ACCUMET Precision Investment Castings

Where parts are intricate or machining difficult, substantial savings can be made by using Crucible Accumet Precision Investment Castings.

The Type 303 Stainless castings shown above (A & B), for example, eliminated practically all expensive machining operations for a manufacturer of milk bottling machinery.

In many cases life of component parts can be greatly extended by using castings of high-alloy grades impractical to machine. The ring illustrated (casting C), used in a fine wire feed mill, is an investment casting made of Crucible *Rexalloy*, a non-ferrous cobalt-chromium-tungsten alloy steel providing exceptional wear and abrasion resistance.

Crucible engineers and metallurgists are available to help you solve design problems or lower production costs with Accumet Precision Investment Castings. Write now for further information.

CRUCIBLE first name in special purpose steels

53 *years of* Fine *steelmaking*

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machining this segment costs — $.70

OILITE segments cost — $.08

machining this mating slide costs — $1.30

OILITE slides cost — $.07

Other Advantages Include:

- No investment in machine tools
- No costly tooling programs
- Releases skilled manpower to other jobs
- No material supply problems

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Oilite Products Include: Bearings, Finished Machine Parts, Cored and Solid Bars, Permanent Filters and Special Units.

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Like Two Peas in A Pod—

Are Products Produced From Correctly Made PMD Dies

DIE CASTING DIES

(The die above shows on the left the upper section and on the right the lower section is shown assembled with cavities and gating.)

Permanent Molds and Cores • Tubular Dies • Extrusion Dies

To insure the adherence to dimensions and maintenance of standards for products manufactured in any of the ways shown above requires their production by the finest-made dies possible. PMD produces dies such as these because we have the "know-how", men with experience, and are equipped with the best of quality machine tools.

PMD

Serving Industry throughout the United States and Canada, PMD Customers include: Major Manufacturers in the Aluminum, Appliance and Automotive Industries. Our staff of specialists is ready and able to meet your most exacting specifications for dies of the highest quality and most intricate structure.

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For additional information Circle No. 33 on the Reader Service Card

BETWEEN THE LINES
continued from page 8

and the other an interesting design study.

From a British die casting consultant we have obtained a detailed account of the way a lead die casting has solved an impossible job. Story begins on page 42.

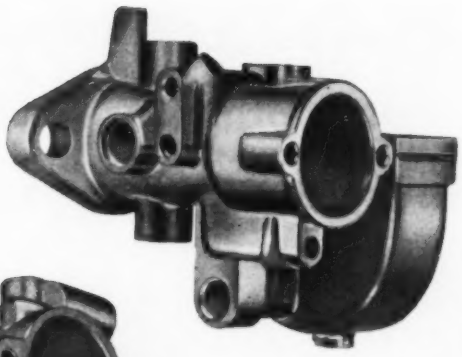
— AT THE REQUEST of the Metal Powder Association, the editors of PRECISION METAL MOLDING are discontinuing the use of the term "sinterings" to denote parts produced from metal powders. This term was introduced during 1952 at the suggestion of various industry groups as a means of simplifying and clarifying the identification of parts produced from metal powders. The nomenclature subcommittee of American Society for Testing Materials has actively proposed this term.

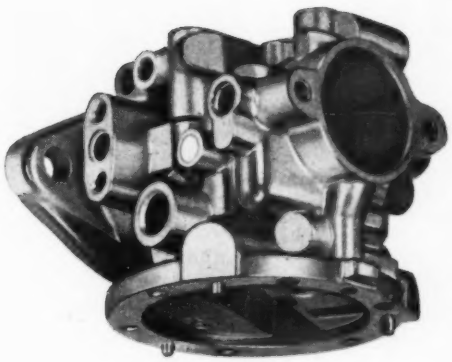
However, according to MPA, objections have been raised because "in the metallurgical field, the product of sinterings is generally a friable product without much strength". It is felt that this is a negative terminology not in keeping with the characteristic properties of pressed and sintered metal powder parts.

The Association advocates that until the matter can be further studied, "the word 'sinterings' not be used as a noun as it might become so embedded in the parlance of the industry that no change could be made later on."

In future writings, PMM will again use the phrase "powdered metal parts" or similar phraseology to indicate parts produced by powder metallurgy.

— ELECTRONIC CORES are an important specialty of the powder metallurgy industry. A definitive report on this use for iron powder starts on page 30.

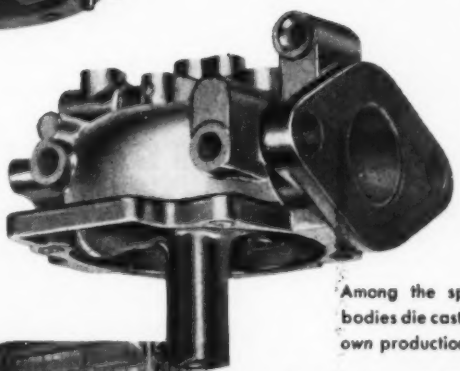




Tillotson Manufacturing Co. writes:

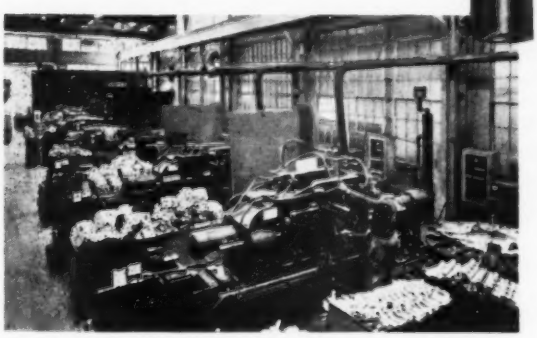
"DIE CASTINGS BY HOOVER help us make a much better product at a much lower cost"

These complex die castings, produced by Hoover for the makers of the famous Tillotson Carburetors, are notable for their intricate coring and many close tolerances. They contain holes on all sides which must be perfectly aligned, and sections of the castings must be free from porosity to prevent leakage.



Among the specific advantages of having their carburetor bodies die cast by Hoover . . . advantages that may apply to your own production problems . . . The Tillotson Company points out:

- **Broader possibilities in engineering design.**
- **Saving in machining time due to large percentage of small holes cored to size and flat surfaces cast smooth.**
- **Saving of number of machines in production line.**
- **Longer tool life, fewer tools required.**
- **Cleaner to handle, less scrap in plant.**
- **Almost complete elimination of rejects.**
- **Smoother, neater appearance and strength with lightweight which have increased our sales tremendously.**



The Hoover Company's complete production facilities for promptly meeting your requirements include 8 zinc die-casting machines, and 27 aluminum die-casting machines carrying ratings up to 400 tons. Castings can be produced from the smallest practical size up to 12" x 12" area and 8 lbs. weight for aluminum and 7" x 10" and 5 lbs. for zinc.

THE HOOVER COMPANY, Die Casting Div., North Canton, Ohio

Get a bid from

HOOVER

Specialists in the fields of die castings since 1922

Write for file folder, "Die Castings." Shows how to step up production and cut costs. Shows their advantages, how they are made, how they should be designed, how they help you step up production and cut costs.

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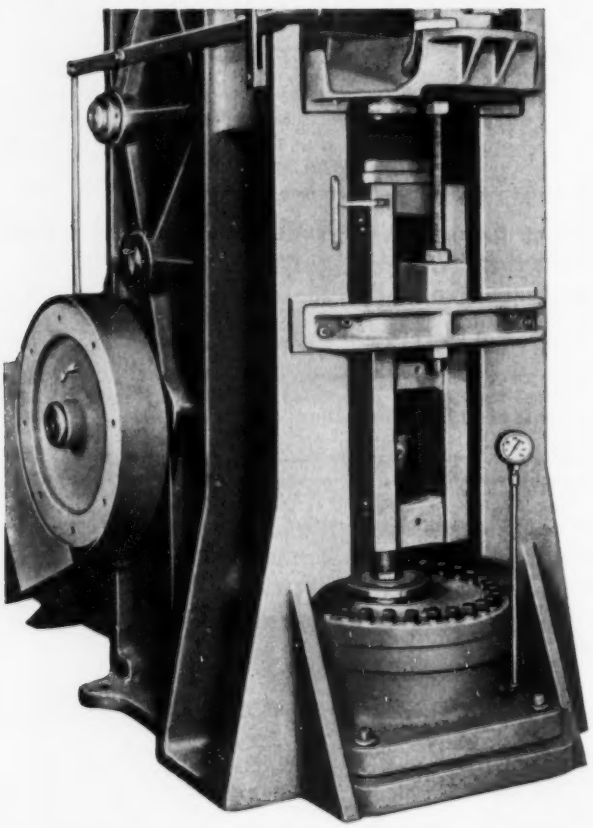
Hydraulic fluid keeps cool while 15 powdered metal parts are compressed per minute under 150 tons pressure

Largest and most powerful of Kux powdered metal presses is this 18,000 lb. Model No. 82. Applying 150 tons pressure to the material, it automatically forms 15 parts per minute in diameters up to 6".

Mounted directly behind the main frame is a complete, self-contained hydraulic unit which delivers 1000 psi to the hydraulic ram — the latter controlling the lower punch during pressing. To make certain that pressure capacity remains uniformly high — *by keeping the hydraulic oil properly cooled* — Kux Machine Company furnishes a Ross Type BCF Exchanger. In this simple, dependable way, lost capacity from overheated, thinned fluid is safely and surely prevented.

KUX PRESSES USE ROSS EXCHANGERS



Safeguarding production capacities of metal working machines is a steady job for Ross Exchangers . . . particularly the rugged, compact, copper and copper alloy "BCF." The fact that it is readily available as a completely pre-engineered, fully standardized unit has long established it as first choice of both makers and users of die casting machines, powdered metal and metal drawing presses, extrusion presses, welders, stoker drives, gear shapers, compressors, engines, turbines and related machines.

For full details, request Bulletin 1.1K5.

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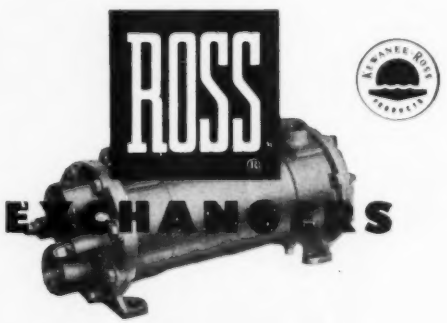
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.



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Here are two of the many reasons why major manufacturers rely on us for quality zinc die castings. We are thoroughly equipped with the most modern equipment available. Production techniques have been developed for fast, efficient and economical operations. Our tool and die shops represent the best equipped in the country. Finally, our staff of skilled specialists is always ready to assist you with your specific requirements.

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No Problem's Too Tough when you call in ... PRECISION

Complicated CORING

Precision's ability to produce die castings involving complicated coring offers you these advantages:

1. Reduces subsequent machining operations.
2. Combines several parts into one die casting, eliminating assembly operations.
3. Makes possible quantity production of intricate parts at much lower cost than by other casting methods.

Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry.

PRECISION CASTINGS CO., Inc.
212 Walnut St., Fayetteville, N. Y.
Syracuse, N. Y. · Cleveland, O. · Chicago, Ill.
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WHY ALDRICH PUMPS CUT FIRE RISKS

● It's simple. With Aldrich Pumps *water* can be used as hydraulic medium, as well as oil. With water, you eliminate chances of plant damage or injuries due to oil fire.

Fire "insurance" like this is important. But so are the many other advantages you'll get when you specify Aldrich Pumps. Here are a few of them:

MORE POWER

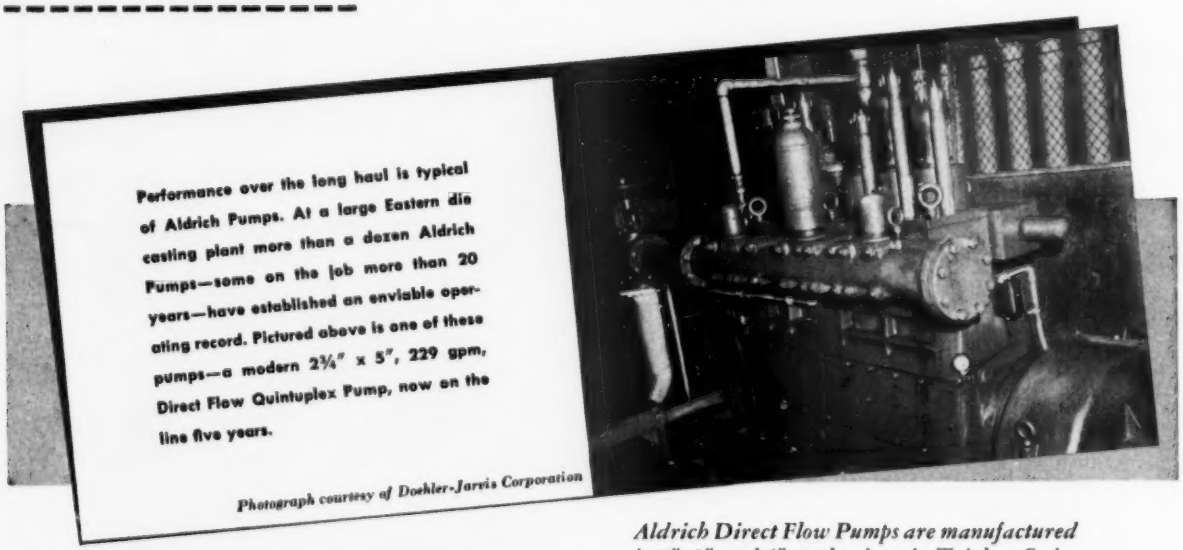
Higher operating speeds afford greater *volumes* and *pressures* from smaller, more compact pumps.

SIMPLE MAINTENANCE

Fluid ends are sectionalized . . . parts can be replaced easily and at low cost. To facilitate changes in pressure and volume requirements, *plunger sizes are easily changeable* . . . in most cases changing them is simply a matter of using new glands, throat bushings and packing in the same fluid end. And, *wearing parts are interchangeable* . . . helping to reduce spare parts costs and inventories particularly when combinations of multiplex pumps are employed.

These are *all* good reasons why Aldrich Pumps have proven their worth over the years with many die casting manufacturers. They are good reasons, too, why you should get more information about Aldrich Pumps.

Write us for catalogs, engineering service, or a representative's call. We invite your inquiries for pumps or complete central hydraulic systems.



Performance over the long haul is typical of Aldrich Pumps. At a large Eastern die casting plant more than a dozen Aldrich Pumps—some on the job more than 20 years—have established an enviable operating record. Pictured above is one of these pumps—a modern 2¾" x 5", 229 gpm, Direct Flow Quintuplex Pump, now on the line five years.

Photograph courtesy of Doehler-Jarvis Corporation

Aldrich Direct Flow Pumps are manufactured in 3", 5" and 6" stroke sizes, in Triplex, Quintuplex or Septuplex models (50 to 900 hp).

THE ALDRICH PUMP COMPANY

25 PINE STREET • ALLENTOWN, PENNSYLVANIA

. . . Originators of the Direct Flow Pump

Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit Duluth • Houston • Jacksonville • Los Angeles • New York • Omaha • Philadelphia • Pittsburgh • Portland, Ore. Richmond, Va. • St. Louis • San Francisco • Seattle • Spokane, Wash. • Syracuse • Tulsa

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DIE CASTING
eliminates four, expensive screw machine parts

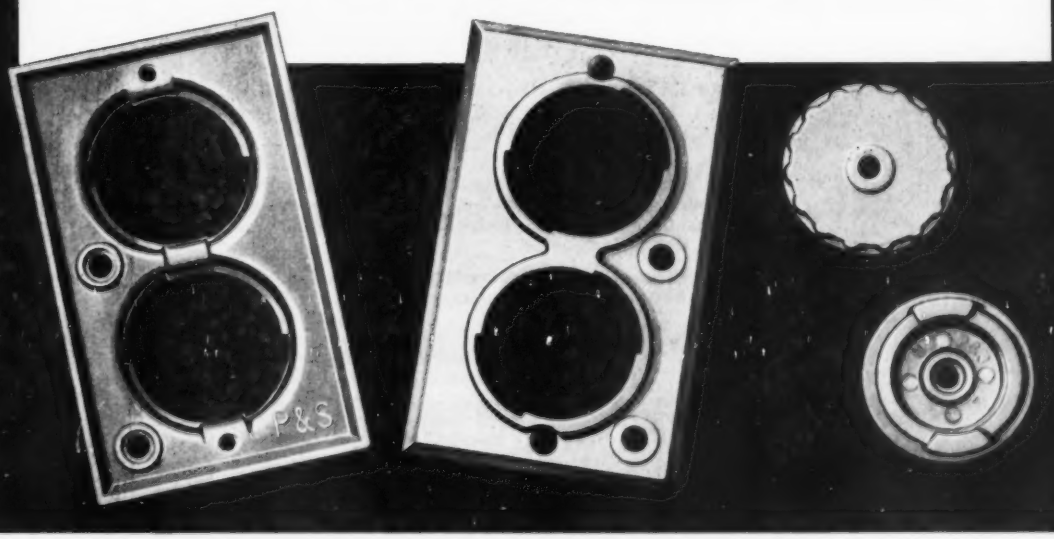
CASE HISTORIES FROM MT. VERNON FILES

When you're looking for ways to pare your production costs and boost your output on metal parts, investigate die casting.

Die casting permits you to produce *intricate* metal parts or sections in a single operation. This reduces and often eliminates, the need for much machining and finishing. As a result, you save time and material. And frequently you can simplify design and lower weight without sacrificing strength or performance. Naturally, you get *better* products, *faster*, and at a *lower* unit cost.

Pass & Seymour's new weatherproof electrical outlet clearly illustrates these advantages. Specifications for this outdoor outlet called for tight fitting, removable caps to make it weatherproof when not in use. Previously, P & S used threaded caps and housings which required four, expensive screw machined parts. Now, die casting has eliminated these parts—resulted in a much more satisfactory product. The new outlet has no threads to cross or catch. Its positive latching cap will not loosen, yet may be latched and unlatched with a simple turn. And its large die cast serrations provide a firmer grip.

The next time *you* have to select a manufacturing procedure remember these advantages of die casting—and consult us. We'll welcome the opportunity to show you how die casting can increase *your output*, improve *your products* and hold down *your production costs*.



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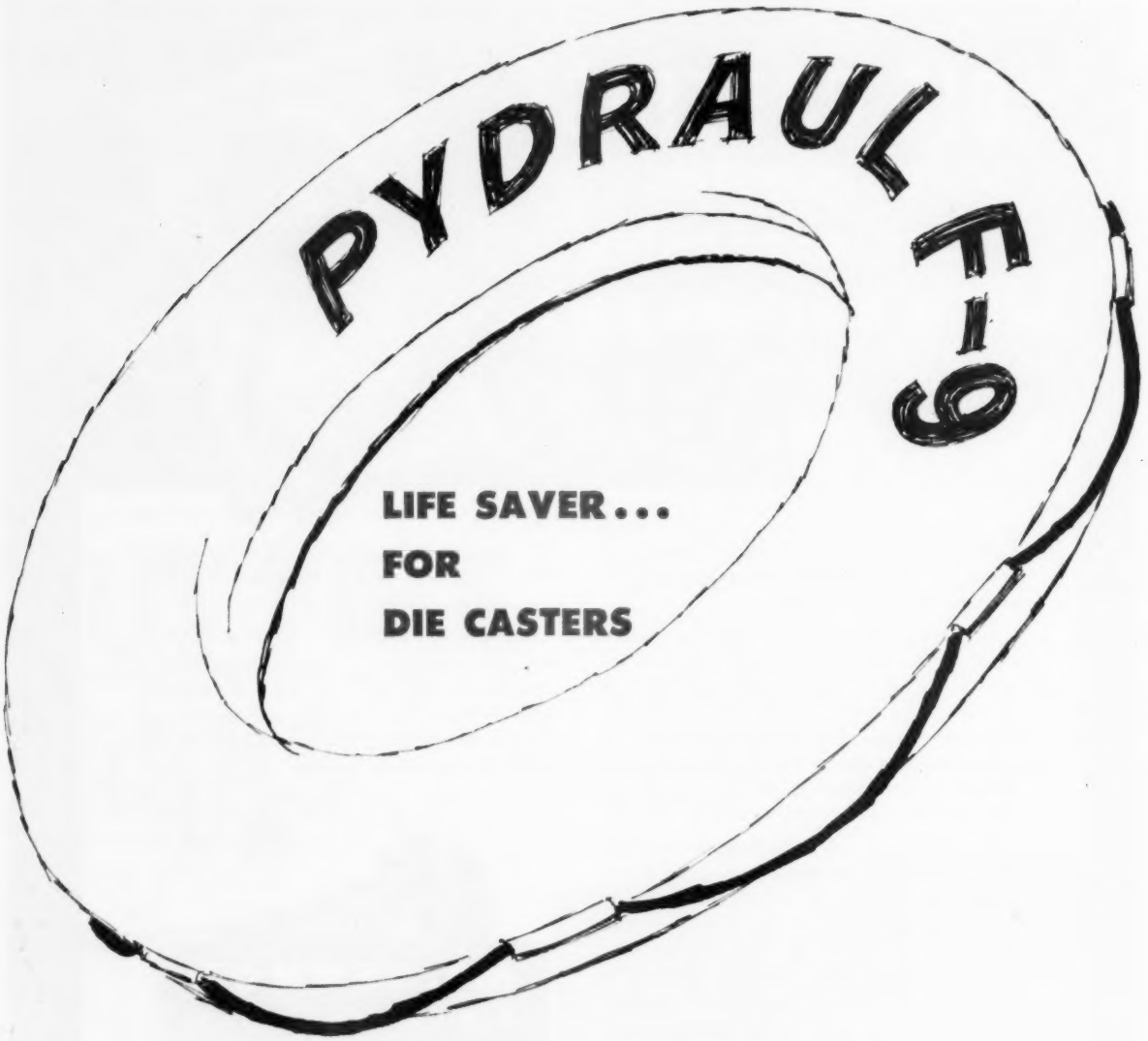

When a discharge line parted recently on a West Coast die-casting machine, the hydraulic fluid—Monsanto's Pydraul F-9—sprayed into a hot zinc melting pot, drenched the machine operator and splattered several onlookers. Result: no fire, no injuries, no production loss.

Without *fire-resistant* Pydraul, the story would have been tragically different. Millions of dollars are lost each year in fires caused by escaping hydraulic fluid.

Why risk losing your plant in a fire of this kind? Under test, Pydraul will not flash or ignite even when poured on molten metal or sprayed into an oxyacetylene flame. Can you say the same about the fluid now in your hydraulic lines?

If not, then drain it out and put Pydraul in. No equipment changes are necessary.

Pydraul Reg. U. S. Pat. Off.

Our specialists will help. Call the Monsanto office near you. Meanwhile, write us for "Pydraul F-9," an informative engineering report. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Mo.

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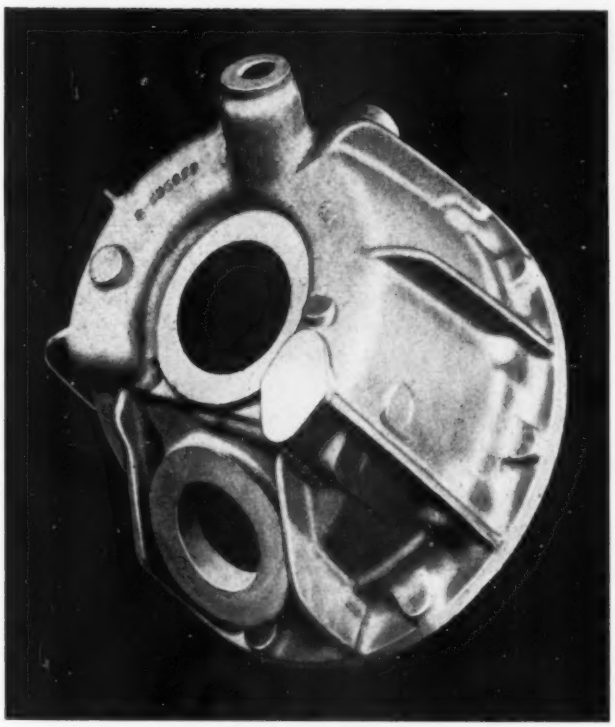
ACME OF CHICAGO

FOR *Quality Light Metal* CASTINGS



TRANSMISSION CASE

This is an example of an Acme magnesium casting. It is the rotor housing for a helicopter. Note that this casting has heavy sections joining comparatively thin sections. Acme produces many castings with these characteristics.

For a better light metal engineering service and top quality in your aluminum and magnesium castings, it will pay you to work with ACME of Chicago.

ACME offers a complete casting service for aluminum alloy permanent mold and semi-permanent mold castings and magnesium sand castings.

Whether your problem is a small component weighing a few ounces or a heavy transmission case or other heavy castings weighing hundreds of pounds, ACME'S 32 years of experience can save you time and money, both in the design and the production stages.

A phone call or letter will bring a competent engineer to work with you on your current problems.

ACME ALUMINUM FOUNDRY CO.

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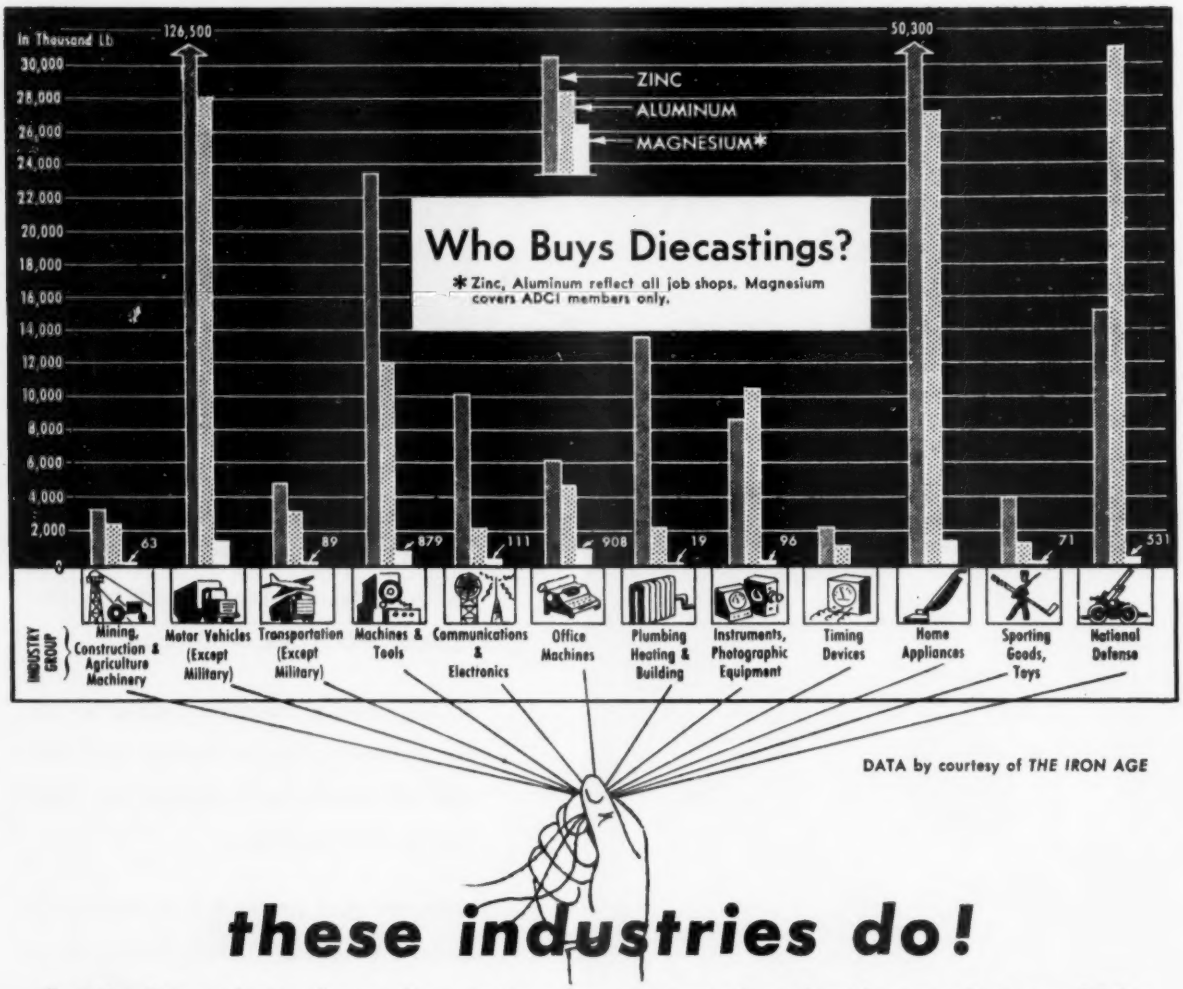

DATA by courtesy of *THE IRON AGE*

these industries do!

Applications of zinc base die castings are so varied and widespread, it would be almost impossible for anyone to go through an ordinary day's routine of living without using—directly or indirectly—a large number of devices, appliances and services in which zinc alloy die castings form essential parts. The chart above, which shows sales by job shop die casters in 1952, tells its own story. More significant, perhaps, is that these sales were nearly six times the value of sales in 1936. Even considering rising costs and prices during the 16-year period, this is a remarkable record, and is representative of the entire die casting industry.

A prime factor in the steadily growing use of die castings has been the recognition of the die casting process for what it has proved itself to be: One of the fastest and most economical production techniques at the command of the metal-working industry today!

DIE CASTING is the Process

ZINC, the Metal

BUNKER HILL, THE PREFERRED ZINC

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WESTERN ELECTRIC EQUIPMENT

Brings "ANYWHERE" Closer to Home!

Strong, lightweight REDUCE COSTS

PARKER DIE CASTINGS on final assembly

Wherever you are, on business or pleasure, your home base is only as distant as the nearest telephone. In business, private branch switchboards like the one shown above speed your voice to a waiting ear. To produce complex telephone equipment for the Bell System the Western Electric Co. uses literally thousands of parts. Among the many specialists supplying components is Parker White Metal Company. Parker Die Castings are used in the assembly as illustrated above. Parker Die Castings require no machining or finishing operations, thus reducing costs. They are produced to rigid specifications, of exactly the right alloy . . . strong and lightweight. Parker Die Castings are in use in nearly every industry and our experience is yours for the asking. Consult with Parker on your next die casting requirements.

and when you think of Die Castings **THINK OF**

Parker White-Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER ALUMINUM *and* ZINC *Die Castings*

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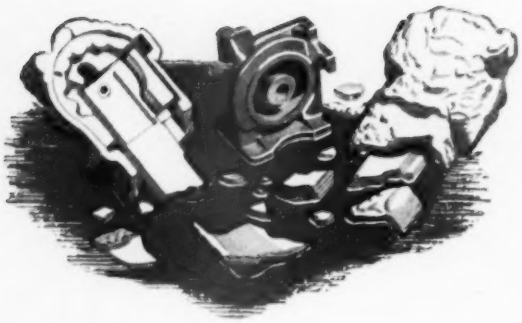
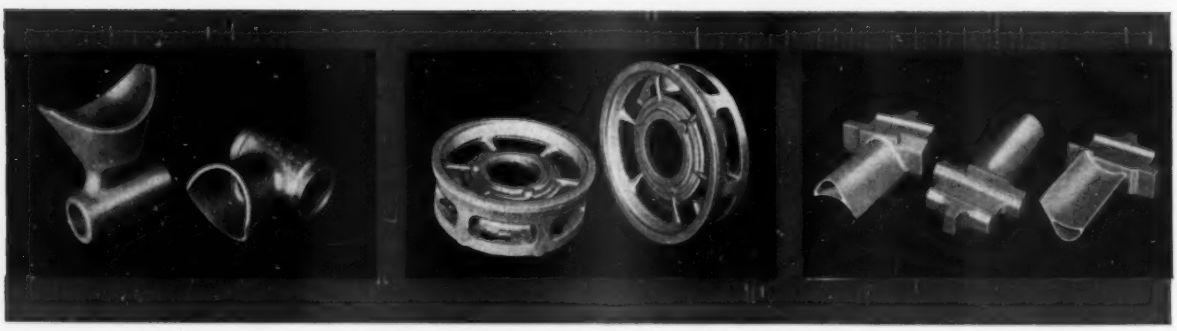


when a part can't be cast... "INTRICAST" it

Ever figured out the formula and the curves for a part, then had to compromise with efficiency in order to come up with a design that *could* be produced in quantity at low cost?

That's the time to think of "Intricast" . . . an ingenious way to make patterns in frozen mercury that permit fast, high-finish castings of highest accuracy and intricate contour to be made on a production line.

The story of "Intricast" parts is too long and too dramatic to be told fully here . . . but write for our 8-page booklet MP-531 which gives all the details. A sales engineer can call at your convenience to help engineer "Intricast" parts into your products.



Metallurgical Products Division

Thompson Products, Inc.

DEPARTMENT MX-8 • CLEVELAND 17, OHIO

For additional information Circle No. 26 on the Reader Service Card

LONGER SERVICE LIFE obtained from powdered metal parts

IMPROVEMENT in function and extension of service life are two objectives every designer seeks. Powdered metal parts very often make these possible.

Just what are the properties and characteristics of powdered metal parts that serve these purposes? Here are a few:

Shape and reproducibility of shape are, of course, prime requisites. Once a hardened steel or sintered carbide die is made, there is every assurance that all of the pieces made on the single set of tools will have the same exact shape and all will be as accurate as the die.

Dimensional accuracy again is uniformly as accurate as the die. Normal tolerances will be about ± 0.003 to 0.005 per inch and eccentricity can be held, particularly on small parts such as cams, to as little as 0.001 TIR.

Wear resistance and hardness. Within extremely wide ranges, almost any hardness desired can be secured and wear will, of course, follow the hardness with the difference that where a porous part can be used, oil impregnation will materially lengthen the life due to constant and adequate lubrication.

Materials of construction are somewhat limited to brass, bronze, pure iron, iron-copper, iron infiltrated with copper, and case carburized steel. More recently stainless steel has become readily available, but its use is not as yet widespread.

The use of powdered metal parts by the Keystone Mfg. Co. of Boston, Mass., illustrates some of the advantages gained by converting from machined wrought metal in the case of three cams used on their 8 mm projectors and cameras.

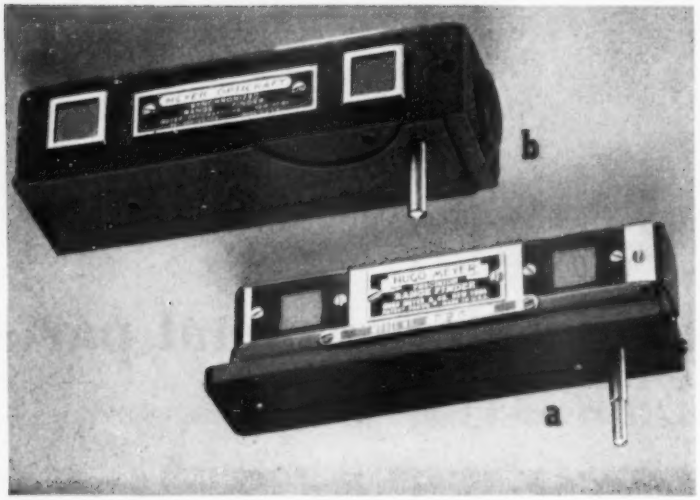
The small bronze cam shown in Figure 1a is finished completely of bronze powder. Eccentricity and run-out are important in this cam and are held to 0.0015 TIR. The three holes are all cored during manufacture. While there is some slight reduction in manufacturing cost, the principal saving comes in releasing machine tools, mostly grinding and screw machines, for other work. Impregnation with oil has given a longer wearing, quieter operating part.

c b a d

1. WEAR RESISTANCE and hardness are desirable features obtained from powdered metal parts, such as these cams for motion picture equipment. Oil impregnatin helps to lengthen cam life.

Figure 1b shows another bronze cam, the in-and-out cam, used on the 8 mm projector. Here a saving is realized by using a powdered

continued on page 68



1.

FROM A FOUR-CAVITY DIE an entire set of die castings for the new rangefinder, above can be produced, supplanting a large number of tools, dies, fixtures and gauges required when the older rangefinder, below, was built of extrusions, stampings and screw machine pieces.

COMBINE AND ELIMINATE: the key to economical use of die castings

By S. SZELWACH*

THE greater the number of individual components that go into an individual assembly, the greater are likely to be the complications in manufacturing.

Q-O-S Corporation (manufacturers of the Meyer-Opticraft line of photographic accessories) were faced with the necessity of reducing costs on an existing model of rangefinder in order to maintain a favorable competitive position.

It was decided to design a new model in spite of objections raised by Sales to the radical change in appearance. By applying a philosophy of "combine and eliminate" it was possible to come up with a design that is simple and rugged. Many parts were eliminated by combining with others. Only in die casting is one able to have almost free rein from a design standpoint.

To what extent the company was successful is apparent in the pictures and description.

In an older type of photographic range finder designed about 10 years ago *using 27 tiny machine screws with fine thread and two pins for assembling, it required drilling and tapping holes in four surfaces;* a dozen of the small screws situated on exposed surfaces had to be "specials" made of stainless steel. That range finder, Figure 1a, was built of brass extrusions, stampings and machined bar stock, Figure 2.

The new Meyer-Opticraft synchronized rangefinder, manufactured under patent No. 2,627,779, Figure 1b, illustrates what can be accomplished by using aluminum die castings.

In this range finder, only nine screws are needed: five for assembling the optical system and four for mounting the cover onto the base. As might be expected, this new unit is far easier to assemble, requires less individual adjustment, holds adjustment better in service and is less expensive to finish.

Due to the peculiarities of assembling onto and inside of the extrusion previously used, many of the screws had to be special, very short and consequently, expensive. The majority were about .060 in length and cost as much as 3½ cents apiece. Tap breakage on small holes was a serious problem.

Changes in design brought about through the use of die cast base, cover and linkage members, has permitted the use of fewer and larger screws of standard sizes. Only nine holes now require drilling and tapping. Number of exposed screws has been reduced from twelve to four.

Reduction in the number of components can be observed by comparing Figures 2 and 3. Parts in the older model included:

- Extruded brass body with milled apertures
- Stamped brass case
- Machined brass or aluminum base plate
- Two extruded mirror holders

*Production Manager, Meyer-Opticraft, Inc., New York, N. Y.

Curved cam made from a stamping and screw machine piece

Two screw machine end caps

Several stampings and screw machine pieces for the actuating linkage

The majority of these have been consolidated into fewer pieces now. For example, the mirror arm assembly has been redesigned so that a single die casting replaces a three-piece linkage.

Because it is possible to "place metal where it is needed" by die casting, the entire mounting and housing is accomplished by a pair of die castings, in place of three pieces formerly required.

Due to changes in design now possible, one cam having a regular curve with true radius has been substituted for three seperate, irregular cams, empirically arrived at and very critical in dimension.

By introducing an adjustment on the mirror-arm assembly, it has been possible to redesign a three-piece actuating linkage into a single die casting.

Only one-third the time needed to assemble the older model is now consumed in building the new range finder.

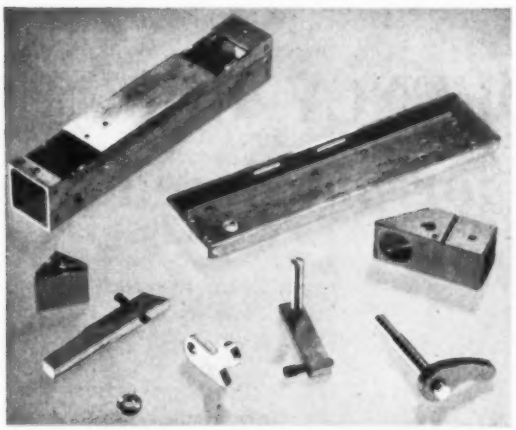
The underside of the old model with base removed, Figure 4, reveals the cams and linkage previously used. This highly precise assembly was used to position the two mirrors mounted *inside* the square brass extrusion which formed the body. Need for precision is so great that a 30 degree rotation of the actuating shaft is required to turn the mirror 1 degree. This rotation must be adjustable by infinite increments of a degree, and the most exacting type of adjusting by skilled instrument makers was necessary.

Now, as can be seen in Figure 3, the entire actuating linkage and mirror assembly are mounted on top of the base die casting where they are easily accessible. By reducing the number of cams and adjustments, and by positioning of a screw adjustment on the outside of the case, assembling and adjusting are enormously speeded.

Finishing, like assembling, is much simpler now. To kill reflections inside the housing, the brass extrusion of which the housing was made had to be swabbed by hand with black paint. Now, with a completely open die cast base and cover, the inside surfaces can be sprayed with paint while the outside is being painted, thus saving an extra operation.

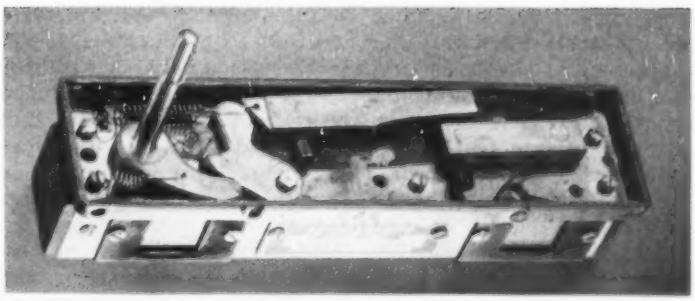
continued on page 72

2.

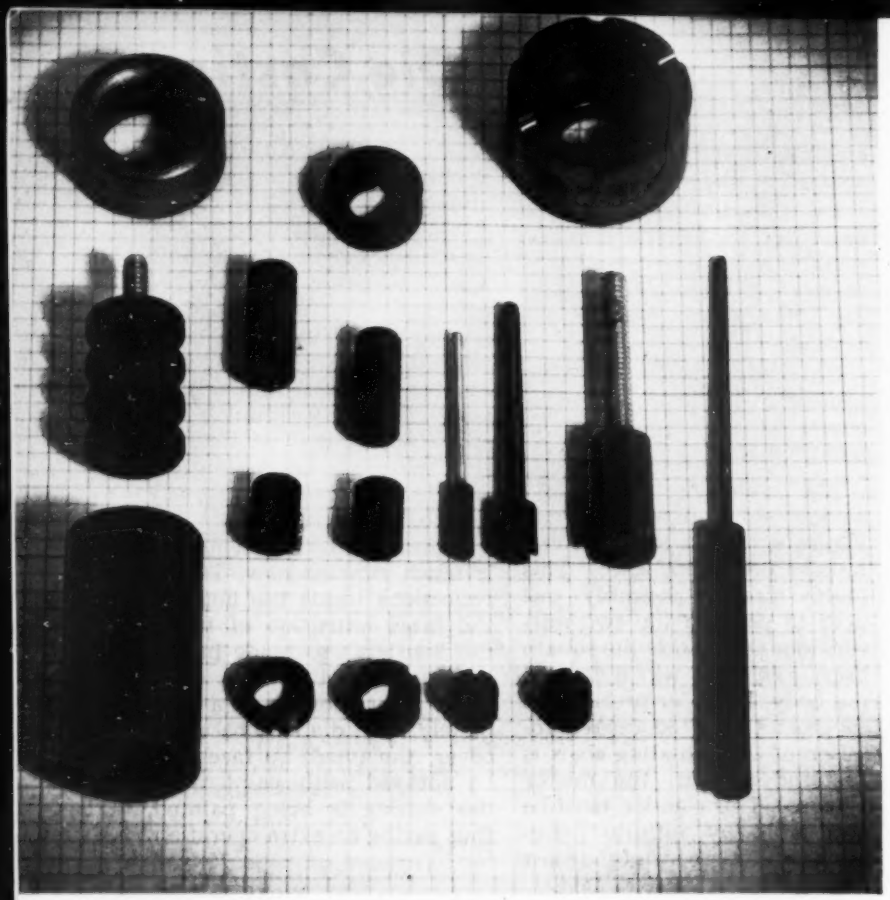


3.

4.



ASSEMBLING INSIDE of an extrusion, above left, has been replaced by an open assembly that is much faster and easier now that die castings are employed, above right. Difficult cams and hard-to-adjust linkage was required in old style range finder, right.



Typical powdered iron cores for the electronics industry. About 23 million of these cores are consumed per month, making this phase of the powder metallurgical industry one of the most important.

HIGH FREQUENCY CORES – an important use for powdered iron

By RICHARD D. PONEMON*

IN the growing field of powder metallurgy, comparatively little information has been published concerning the manufacture of powdered iron cores, one of several unusual specialties in our industry. A recent survey indicated expenditures for powder metallurgy products of approximately $40 million in 1952, an admittedly ultra-conservative estimate. Powdered iron high-frequency cores accounted for some $5 million of this figure, a substantial proportion for a specialized product.

The usage of powdered iron as an electronic core material developed from the fact that non-powder cores introduced inefficiencies into alternating current electromagnetic circuits. These inefficiencies include eddy current loss, hysteresis, magnetic remanence, and other losses, all of which decrease the circuit efficiency as frequencies rise. At frequencies of 100 kc/sec and over, most non-powder core materials have such high losses that eddy current losses alone forbid most applications. (A significant exception is ferrite, a magnetic ceramic material. Ferrites generally show extremely high permeability with low loss characteristics.

Present usage exists mainly below 100 kc.)

Since eddy current paths tend to decrease with physical size of the iron piece, the employment of many thousands of minute particles greatly reduces these losses by shortening the paths. At the same time, enough lines of magnetic force can be induced into a coil through the powdered iron piece so that the advantages of high permeability are present. It is this combination of relatively high permeability with low losses, at high frequencies, which is the prime characteristic of powdered iron cores.

The major electronic core applications are in electronic transformers and variable inductors. Cores are used to adjust or vary inductance and to obtain a relatively high inductance in a small space, Table 1. Shell and cup cores are used to confine stray magnetic fields and as an aid in coupling.

Modern production-line requirements of inter-changeability demand the close control of permeability and loss factor tolerances in addition to the expected mechanical tolerances. Because of these electrical requirements, powdered iron core raw materials and manufacturing processes differ in many respects from those employed in the production of powdered metal structural parts.

The most commonly used raw materials are powdered irons prepared by the carbonyl process, in which iron is heated in carbon monoxide and reacts to form iron pentacarbonyl gas. Additional heating decomposes this gas and deposits pure iron in the form of microscopic spheres varying in size from 3 to 20 microns in diameter. Particle size and shape are controlled by variations in temperature, pressure and other conditions during this last heating stage.

Other high-purity irons are prepared by the more familiar electrolytic and hydrogen reduction processes, as commonly used in the preparation of powder for structural parts. Certain magnetic oxides are also used in VHF and UHF applications and to a limited extent at broadcast frequencies.

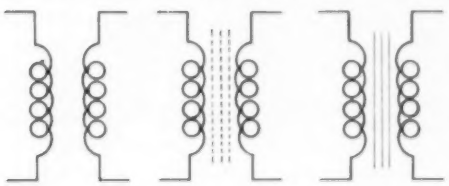
Losses are largely determined by the raw iron particle size, shape and size-distribution, hence uniformity from lot to lot is of the utmost importance. The controls required of the iron powder manufacturers, in order to achieve this uniformity, bring the cost of these grades of powder to a point much higher than most powders used for mechanical parts. Costs vary from about 25c to $2.50 per lb., averaging about 80c, with very few applications permitting the use of lower cost materials. High cost materials and close electronic tolerances require great care in the preparation of the materials to prevent wastage and to insure uniformity.

The first step in material preparation is the insulation of the particle. This process is

continued next page

TABLE ONE

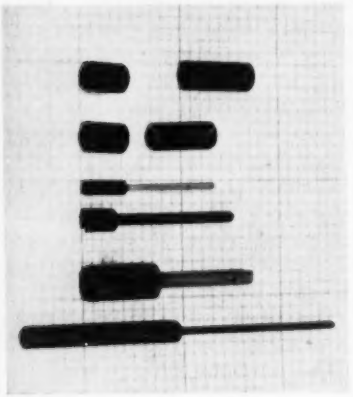
POWDERED IRON CORE COMPARED TO AIR AND LAMINATED IRON CORE AT FREQUENCIES OVER 100 KC



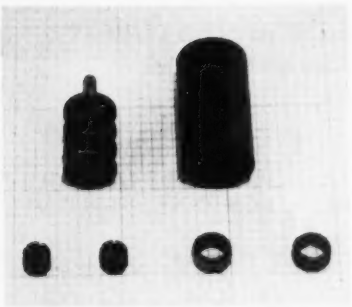
	AIR CORE	POWDERED IRON CORE	LAMINATED IRON CORE
SIZE	Larger unit	Smaller unit	Usually not usable because of high losses.
WIRE COST	Most wire	Less wire	
SHIELDING	Separate Shield	Shield can be made as integral part of unit.	
COUPLING ADJUSTMENT	Requires movable coil or trimmer capacitor to vary coupling.	Uses low cost core	
INDUCTANCE ADJUSTMENT	Not adjustable	Readily adjustable	
DISTRIBUTED CAPACITY	Higher	Lower	
LOSSES	Lower	Higher	

*Pyroferric Company, Inc.

HERE ARE A FEW OF THE MILLIONS OF CORES PRODUCED FROM IRON POWDER:



Threaded and insert cores . . .



Sleeve cores (shields) and bobbin type cores . . .

Television deflection yoke cores . .

needed in order to maintain the integrity of each particle, with the final goal of minimizing losses. The insulation is usually accomplished by mixing the raw iron in a mild acid solution under carefully supervised conditions. The surface of each particle reacts with the acid to form a non-conductive metallic salt coating or skin around the particle. After the reaction is complete, the solvent is driven off as completely as possible by heating, further agitating and air-drying.

Since powdered iron high frequency cores cannot be sintered without destruction of the insulation, and consequent fusing of the particles, the cores are held to final shape by a plastic binder, usually a thermo-setting resin. The binder mixing process takes place in bakery-type mixers into which the insulated powder, the resin and sufficient solvent to mix a thin slurry have been added. Complete dispersion of the binder is essential to final strength and is achieved by thoroughness in mixing prior to removal of the solvent by evaporation. In large scale mixing operations, the solvents are frequently recovered and re-used. After the iron base has been dried to consistency of a wet clay, it is removed from the mixer for further drying and classification.

On coming out of the mixer, the powder is in relatively large lumps, These lumps are reduced in size by passing the material through a pulverizer or comminuter in either the wet or dry stage, depending upon the ultimate requirements for the particular mix. Remaining solvents are volatilized by air-drying, or in low temperature drying racks. In order to prevent partial curing of the resin, it is imperative to keep the temperature of the mix well below the minimum setting temperature of the plastic. Even partial curing during the drying process can result in pressing difficulties and ultimate weakness of the finished piece.

Some degree of moisture content is necessary to permit plastic flow under pressure during the compacting operation. The line between too much and too little moisture is a difficult one to follow, but must be controlled for optimum pressing and strength characteristics. Powder which is too moist will not flow properly and die fill will be irregular. Powder which is too dry will have relatively little plastic flow under pressure and will behave much like sand, having poor green strength and uneven density.

The "dry" powder at this stage consists of agglomerates held together by the resin and incorporating many hundreds of the original insulated particles. The proper size and sieve distribution of these agglomerates determine the flowability of the powder as well as the density and strength of the green compact, much as in the production of sinterings.

The "dry" agglomerates are segregated by size in a multi-deck screen classification. The proper mesh sizes are selected and blended together at the same time the die lubricant, a metallic stearate, is tumbled into the mix. After tumbling, the material is ready for pressing.

Most powdered iron cores are pressed on automatic presses, although several types of low-permeability sleeves, used as magnetic shields, are cut from extruded tube. Capacities of presses in common use vary from 2 to 100 tons and forming pressures up to 50 tsi are employed. As the illustrations indicate, most shapes are simple cylinders, with few variations on the cylindrical theme. Diameter tolerances on the pressed parts usually allow a total variation of 5 mils. Length tolerances are usually plus/minus 10 mils.

continued on page 74

COSTS CUT–PERFORMANCE IMPROVED

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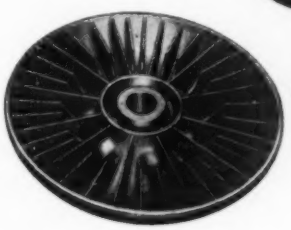
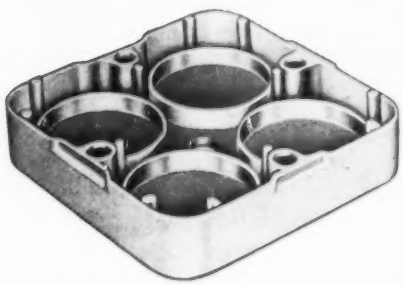
Outboard Propeller



Gyrol Fluid Coupling

Garbage Disposal Housing

Rocket Carrier Base



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1. COLOR ANODIZED to indicate the type of gas, this aluminum die cast bonnet for a gas pressure reducing valve replaces a bronze forging.

2.

IS A BRONZE FORGING NECESSARY . . . ?

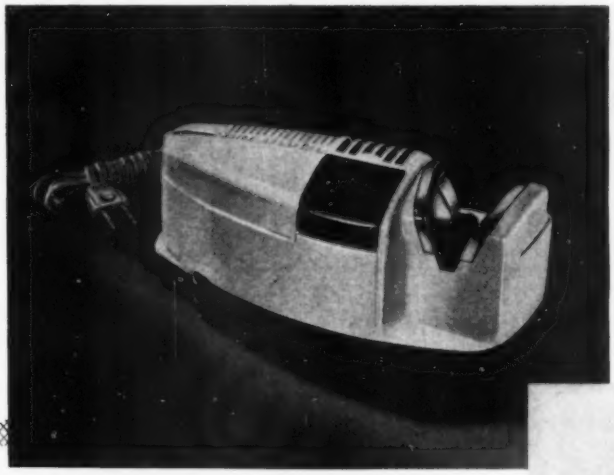
PRESSURE regulating valves of the type illustrated in Figure 1 are usually of forged bronze construction. The valve bonnet, however, is a non-pressure carrying member and the use of a forging is more a habit than a necessity. National Cylinder Gas Co. has changed to a die cast aluminum bonnet where high strength is not a factor.

The first, and most obvious, reason for the change is to provide a line regulator at lowest cost. The bonnet shown in Figure 2 is cast by the Parker White-Metal Co. and comes to the user essentially completed. Because there is considerable wear on the threads in the bonnet neck, a steel insert is pressed in after the casting is received. This insert, easily and cheaply made on a screw machine, could perhaps be eliminated and the neck threaded to receive the regulating screw, but as a safety factor only, the insert is retained. Normally, such a steel part would be cast in during the die casting operation. Anchorage adequate to permit threading is, however, difficult to secure.

This particular line of regulators was originally designed to use the die cast bonnet. At the time the part was designed, however, engineering estimates of costs of both brass and bronze forgings were made and showed that the cost would have been between two and three times as much as a die casting.

Coloring of the bonnet is another advantage of die casting. with either brass or bronze, a paint or lacquer finish would have to be used. Experience has shown that these finishes do not resist perspiration or abrasion to which they are exposed in this application. With an aluminum die casting, however, color anodizing has proved suitable. A low silicon aluminum alloy is used to permit the best finish since high silicon produces a streaked or smutty film. Characteristically, the oxygen regulators are anodized green and the fuel gas regulators red.

ANOTHER DIE CAST PRODUCT MADE BETTER ON KUX DIE CASTING EQUIPMENT



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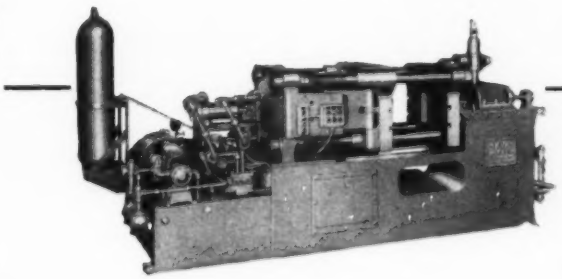

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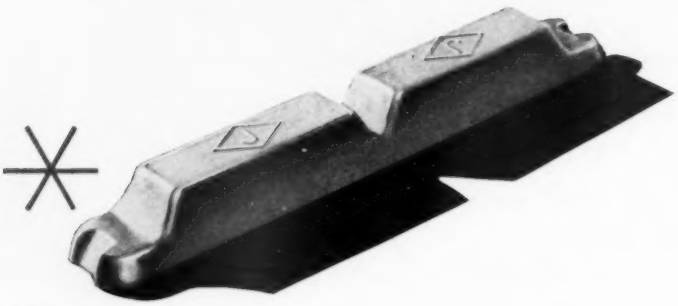

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FLATNESS AND DIMENSION are held in these shell mold castings

By WALTER CUSKIE*

ANY method of fabrication that will lower manufacturing costs, reduce the work burden on installed machine tools, or prevent either the purchase of new machines or the sub-contracting of a job is, inevitably, going to make a profound impact on the metal working industry. So-called "shell molding" is certainly such a production method.

This new casting procedure may revolutionize the foundry industry by lowering costs through mechanization and reduced scrap losses and by making a sand foundry a cleaner, better place in which to work.

As the techniques for making shell molds become better known and as automatic machinery is developed for making these molds, more and more ferrous and non-ferrous foundries will turn to this method of production for all parts that are made in sufficient numbers to justify the making of a metal match plate type of pattern.

Not only will the existing sand foundries turn to this newer production method, but other types of metal casting installations will add shell molded casting to their facilities as a complementary process.

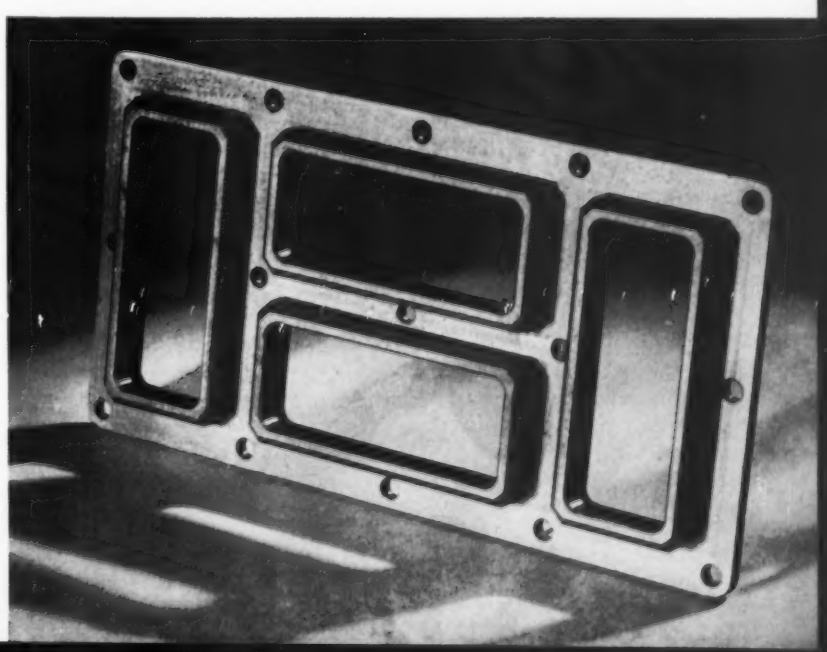
One contract fabricator who has already done this is the Investment Casting Corp. who make the plug fastener plate shown below for the Reeves Instrument Co.

As originally designed, the plate was sand cast in aluminum. Flatness and accuracy within relatively close tolerances are required and, in addition, the plate had to be anodized for corrosion protection. These requirements meant that the part had to be machined all-over as can be seen in the illustration which is, actually, one of the older sand cast plates fully machined and ready for anodizing.

When the part was converted to a shell mold casting, still in 365-T6 aluminum, some impressive savings were made. The cost of the new casting is the same as the

continued on page 65

*Sub-contract supervisor, Reeves Instrument Co., New York, N. Y.



THIS FULLY MACHINED sand casting has been replaced, at a marked cost reduction, by a shell molded casting requiring practically no finish machining.

Permanent mold castings on the outside give MORE WORK SPACE INSIDE

By D. T. LAWRENCE*

WHEN stacked core laminations are held together by a pair of end brackets, as in the constant voltage transformers manufactured by Sola Electric Company, aluminum permanent mold castings make very effective end pieces. Our experience using this type of casting has caused us to standardize on permanent mold end brackets for all except limited production models, where we still use sand cast frames.

In a "sandwich" type structure such as this, the laminations are firmly and uniformly clamped by through bolts extending between the end brackets. Although there are no moving parts in the entire assembly, and no working stresses to be met, the need for strength and rigidity is an important consideration in designing the end brackets.

Particularly the sections around the bolt holes, and the areas where the entire transformer is mounted to a base, need to have sufficient strength so that they do not crack during assembly or shipping. It was possible to get this amount of strength in the old type end brackets that were sand cast, but only by allowing extremely heavy sections. Now we have been able to attain the needed strength, while also getting lighter wall sections, less metal consumption and greater uniformity from piece to piece.

By lightening the entire frame, we have been able to remove metal from the inner surfaces of the frame castings, since the outer contour is determined by the profile of the laminations and cannot be arbitrarily reduced. *Thus, we have opened up the interior areas and eliminated a cramped condition which made wiring very difficult. There was so little space around the inside when the frames were sand cast, that the lead-ins and lead-outs were wedged in tightly and we found it desirable to add extra insulation for protection. Now, with more space to work in, this extra insulation is not necessary.*

Tooling costs are, naturally, considerably more for the permanent mold castings than for the sand castings, but we have standardized our multitude of special models into the two basic sizes, thus permitting wider amortization of mold costs and establishing sufficient quantity of pieces to justify the expenditure.

Two commercial permanent mold producers make the castings for us: Aluminum Casting & Engineering Co. makes the larger frames, and Meta-Mold, Inc., makes the smaller ones.

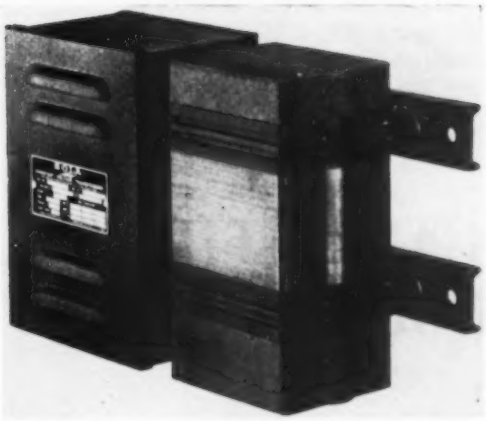
Magnetic shielding is another important function required of the end frames. Aluminum is entirely satisfactory for this purpose, whether sand cast or permanent mold cast.

All aluminum castings are heat treated before assembly to improve their metallurgical properties and relieve stresses.

From the point of view of precision, the permanent mold casters are able to give much better results than is possible by sand casting. While it is not necesary to hold exceptionally close tolerances, there are at least two places where we have asked for and received special allowance.

The perpendicular relationship between the lower mounting surfaces and the inner surface that presses against the stacked laminations several inches long is held by two end

*Chief Draftsman, Sola Electric Company, Chicago, Ill.



"WE HAVE STANDARDIZED our multitude of special models into two basic sizes, thus permitting wider amortization of die cost . . . "

plates, any slight off-perpendicular mounting angle would throw the bolt holes out of line and create stresses in tightening.

The other consideration is a matching of the outer contour of the casting with the outer contour of the laminations, so that it presents a smooth and continuous surface.

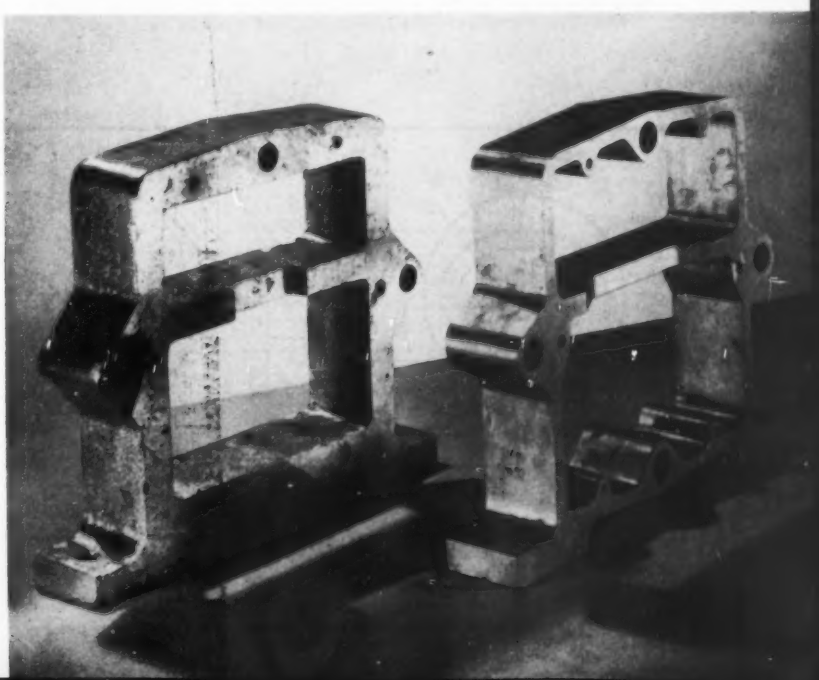
Both of these considerations have been met by the permanent mold casters *by taking virtually all of the draft requirements on the inside surfaces of the castings,* thus permitting the outer surfaces to be cast with almost no taper.

Another helpful "trick" of the permanent mold casters has been the provision of cored bolt holes in two different positions, depending upon the design, but using the same molds. When a transformer is longer than six inches, the bolt holes are located in ears extending from the edges of the castings, but for the smaller models, the bolt holes are cored directly through the normal wall thickness. By means of plugs in the molds, either type of bolt hole location can be cast from the same molds.

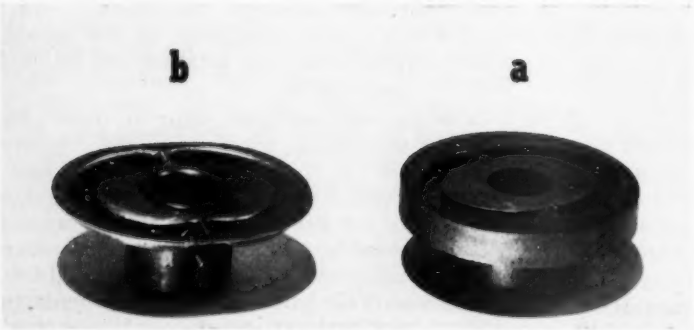
Because wall sections can be more accurately controlled, metal is placed "where it is needed" in these permanent mold castings, and excluded by means of metal savers where it is not needed. Thus, cored recesses on the underside, and a ribbed circumference on the smaller castings, reduce the weight of metal used. This saves on costs and tends to give sounder castings.

Altogether, from considerations of performance, manufacturing and costs, aluminum permanent mold castings have proved themselves in these transformer end brackets.

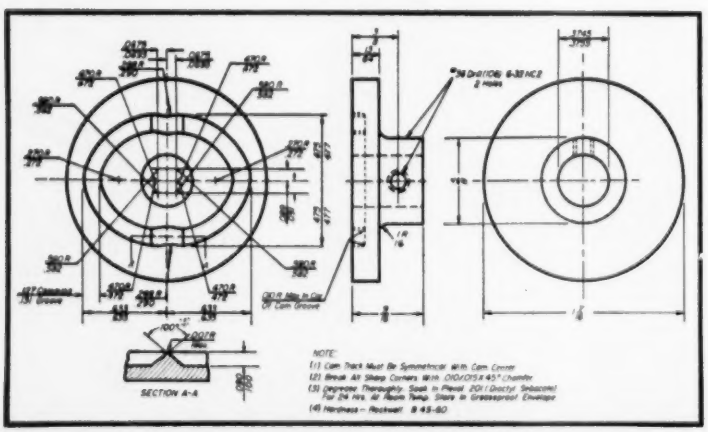
"WE HAVE BEEN ABLE to remove metal from the inner surfaces by means of permanent mold castings (right), opening up the interior areas and eliminating a c r a m p e d condition which made wiring very difficult . . . "



THE CAM'S THE THING — pressed from iron powder and infiltrated with brass



The powdered iron cam "a" can be made economically and will operate satisfactorily. the assembled cam "b" does not operate properly and could not be made economically. Below is the detail drawing for the powdered iron cam showing the close manufacturing tolerances that must be met.



FEW, if any, other machine parts demonstrate the remarkable flexibility of the powder metallurgical process as well as cams. These parts require, at one time or another, practically every special feature that makes powder metallurgy unique as well as all of the standard metallurgical characteristics.

The light duty cams can be relatively porous members impregnated with oil. For heavier duty the same structure may be used, but the cam must be case hardened to give more adequate wear resistance or, in some cases, greater impact strength. Still another important advantage is the duplicability from piece to piece, often with a smaller allowable variation than can be secured economically by any other means.

Where a difficult cam contour is combined with the need for good wear resistance and precise delivery schedules must be met, the advantages of a powdered metal part become outstanding.

The cam used by the Dictaphone Corp. of Bridgeport, Conn., Figure 1a, is one of these. At first glance it would

seem that this part would present no problems in manufacture. Closer examination, however, reveals that no machining method can make the part with the required degree of accuracy.

Standard machining practice using a pantograph type of duplicator cannot give either the dimensional accuracy required as far as groove contour is concerned nor can the 0.007 max. radius on the point of the rise be maintained. These requirements are indicated in Figure 2.

During the early stages of manufacture an attempt was made to fabricate this part by forming the cam as a metal pressing and the hub as a screw machine part. These two pieces were then assembled by pressing the cam onto the hub and rolling over a thin edge to lock the parts together. Such an assembled structure is shown in Figure 1b.

All of the troubles as far as shape and accuracy are concerned that would be characteristic of a fully machined piece are present in this structure as well as some that are unique to the method of manufacture.

Wear improved by infiltrating with brass

While only a few hundred parts were made by this method, it became evident very quickly that a better means of fabrication had to be secured. Resort was made, therefore, to powder metallurgy.

The earliest cams were made of iron impregnated with oil. Dimensionally and functionally these parts were satisfactory, but wear resistance was not good. To improve this last characteristic without destroying the good features of the powdered metal cam, infiltration with brass was used. By this technique, it is possible to maintain the accuracy and reproducibility of the pure iron powder parts and, at the same time, increase the resistance to abrasion and wear by forming a fully dense, harder part. The cam as finally developed by the Wel-Met Co. is the one shown in Figure 1a.

Because of the limited production of this part by any method other than powder metallurgy there are no accurate figures of costs available. Engineering estimates, however, are that a sinteing is some what less expensive than the assembled cam if the number of rejects of the assembly were not considered. When, however, the high percentage of rejected cams is considered there is no doubt that powder metallurgy is by far the most economical method.

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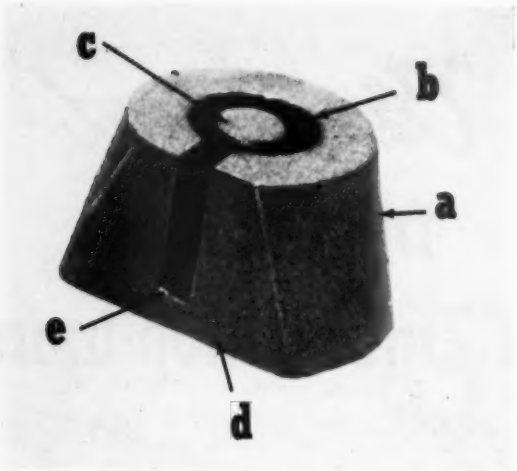
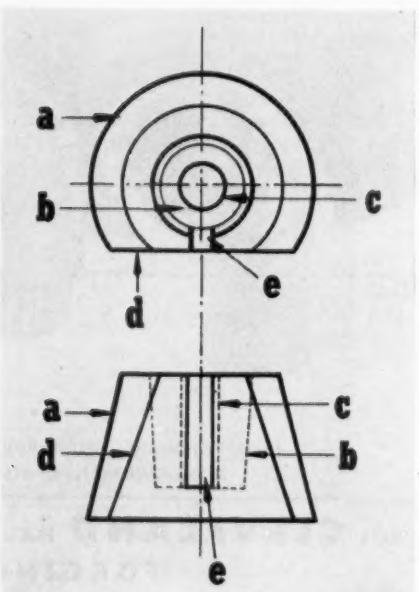
LEAD DIE CASTING: case history of a part that was "impossible" by any

By W. M. HALLIDAY*



1. INITIAL ORDER of these small antimonial-lead die cast plugs called for 700,000 pieces, ample to justify tooling costs and still represent substantial piece savings.



2. MULTIPLE DIFFICULTIES were encountered in trying to adapt this piece for production by automatic screw machine, stamping or any other method.

CAN the die casting process be utilized to produce pieces that are actually impossible by other conventional processes? This is often the case, although designers have sometimes been sceptical of such claims.

It can be said with accuracy that the limits as to size, shape and design detail are much wider with die casting than with any other high production process.

The following case history of a product development is a notable example of the ability of die casting to achieve a result which, in this instance, was physically or economically impractical by any other method.

Here's what was needed . . .

The component is a special conical sealing plug for use in conjunction with a mechanical metering unit of rather complicated construction which embraced a large number of other parts. The character of these latter and the manner of their assembly and operation had been previously determined and no modifications could be entertained.

Thus the shape, features and sizes of the sealing plug, Figure 1, could not be altered to any appreciable degree in order to obtain more simple adaptation of the part for its manufacture by any of the ordinary methods.

At first glance, the sealing plug would appear to present

*British die casting consultant.

other method

no insuperable problems for manufacture by machining in the automatic lathe, but a closer study confirms such a judgment to be wrong.

The manufacturer encountered the following serious obstacles.

A very large quantity of these plugs was required, i. e. 700,000 on the initial order, with regular repeats of a comparable size. Parts had thus to be reproduced in the most inexpensive fashion, and with the minimum cost for tooling or waste of raw materials.

The metering device in which such plugs were to be in corporated was employed to control the flow of a slightly acid solution flowing in such a manner as to be almost constantly in contact with the sealing plug. A hard-grade antimonial-lead. was selected as being sufficiently corrosion-resistant, low in cost, and capable of withstanding normal mechanical wear during operation. It was found feasible to have this material supplied in short extruded rods suitable for machining to shape in an automatic lathe which method it was hoped would prove practicable.

How close must dimensions be held?

The greatest objections arose in connection with the shape, form and dimensional accuracy required.

The plug component, Figure 1a, is of quite small size, having a conical exterior the sides of which are inclined to the inclusive angle of 26 deg. The maximum and minimum diameters of the part are ⅞ inch and ⅝ inch respectively.

Close tolerances had to be observed in respect of these diameter dimensions and also the overall length and angle of taper to ensure that effective sealing would be obtained when the finished part was assembled in a conical seating of the metering device. Tolerances of ± .001 were permissible on the two end diameters, and the length held to ± .002.

Up the smallest end of the plug is a blind conical hole, b, strictly concentric with the OD. The largest diameter of this hole (at the end of the plug) is .375 the smallest .288. Depth of the hole is .500

Tolerances relating to the sizes of this hole are also fine, i. e. ± .001 on maximum diameter, twice this amount of the small diameter, and the same limits on eccentricity with the outside of the component. The depth had to be held to a tolerance of ± .002 and the bottom surface of same had to be perfectly flat and formed with sharp corners as shown in Figure 2.

Formed integral with the plug and situated exactly concentric with hole, b, is a small cylindrical stalk, c, of .130 diameter. This is parallel over its entire length which dimension is the same as that of the depth of hole 'b', so that its endface will lie exactly level with the smallest diameter end of the plug. This stalk is to be held concentric with hole 'b' within a maximum of .002 off-set, and limits set covering variations of its length are ± .001.

Across one side of the plug exterior is a flat, d, which is parallel with the centre axis of stalk, c to the closest possible limits. As seen, the flat extends the full length of the plug, its depth being controlled to ± .002 to ensure a uniform thickness of wall between the adjacent hole.

Through the remaining wall between flat and hole is the rectangular slot, e, .100 wide ± .001. This extends fully into hole, b, and its length coincides with the depth of that hole to the same tolerances. The slot lies truly central with the stalk to a permissible error of ± .001. The termination of the .500 long slot near the largest end of the plug is finished with sharp corners, and of course in strict line with the base of hole, b.

The surface finish to be obtained on all these portions of the plug has to be as smooth and even as possible; the sides of conical hole, b, and stalk, c, are especially important in this respect.

Can it be machined?

In considering the most economical or feasible method of manufacture for such a precision type sealing plug purely machining operations were immediately ruled out for several reasons.

For example, tooling an automatic lathe to bore hole, b, to the close tolerances, fine finish and with square corners required at the root, was a wholly impracticable proposition. A cutting tool would have to be accommodated within a narrow space of only .079 situated ½ inch deep in the component.

Such a slender tool cutting at a distance of not less than ⅝ inch from its point of clamping support was impossible to envisage.

Similarly, the machining of the critical stalk, c, for which an equally slender unsupported tool would be needed, was out of the question. Furthermore, turning and boring of the plug could only be accomplished by several different chucking operations, since all portions of the form could not be produced at a single setting. Jigging difficulties of a very serious kind were thus pre-

continued on page 84

INDEXING FROM CORED HOLES simplifies alignment

By E. M. BROWN*

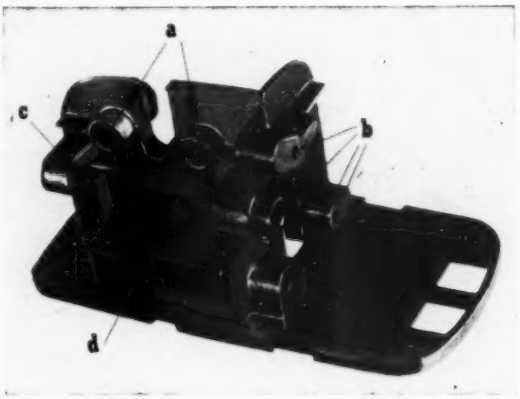
IN the knife sharpener manufactured by the John Oster Co., of Racine, Wis., one of the major design problems was to fabricate a base and mounting member such that all of the component parts could be held in exact alignment. This base member had to be sufficiently rigid to allow fastening of all of the components to it in such a manner that the plastic housing covering the "works" needs no structural properties. As finally designed, the base and frame is a single zinc die casting being made for the Oster Co. by the Racine Die Casting Co.

With the exception of the grinding wheels, a unit such as this knife sharpener is expected to last indefinitely. Alignment of the motor, drive shaft and grinding wheels is, therefore, of prime importance. To secure the necessary degree of alignment some gauging points had to be established and all other important holes and surfaces indexed from them.

In this sharpener frame the two cored holes for the grinding wheel bearing shafts were selected as the gauge points. These holes, indicated as "a" in Figure 1, are accurately positioned by stationary cores in one of the die blocks. The motor mounting holes and the right hand drive shaft bearing hole, "b" in Figure 1, are cored in a movable gib so that adjustment of position with respect to the index points can be made relatively easily. The adjustment is possible in a direction parallel to the axis of the index holes and also at right angles to them so that both distance and parallelism can be corrected when necessary.

The left hand drive shaft bearing hole has its core rod mounted on another adjustable gib that operates independantly. With these two adjustable core blocks it is possible to maintain position and parallelism within 0.001 and parallelism of the motor mounting bosses within 0.003 TIR. During the casting operation it has been found necessary to gauge the castings about once an hour and make such changes as are necessary.

Ordinarily, a die casting foundry does not attempt to hold such close tolerances due to the increased cost of the individual castings. In this case, however, the cost increase, neglecting greater die cost for the moment, is less than the cost of machining would have been. As far as die costs are concerned, a die of the type used on this casting is considerably more expensive than if the positional adjustments of the core rods were eliminated. However, a unit such as the knife sharpener has a very stable design so that the same die can be used for a period of years. Under such



1. The aluminum die cast frame of the knife sharpener. All components are fastened to this frame so that the plastic cover acts only as a protective shield and decorative cover.

*Vice President (Production), John Oster Co.

continued on page 66

PMM

Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating, or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

A Section Devoted to Specialized Finishing of

Die Castings • Investment Castings • Powder Metal Parts
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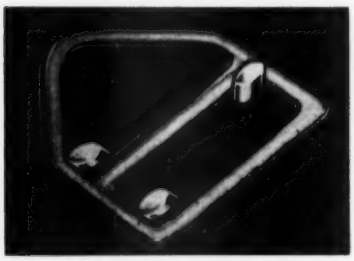
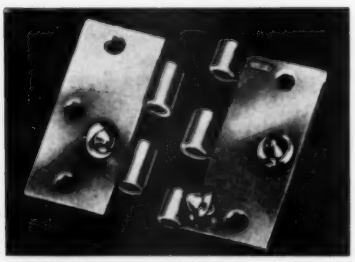
Choosing the right ball depends upon the shape of the part to be finished.

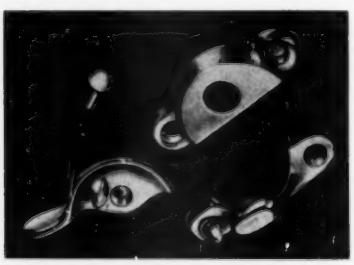
STEEL BALLS, round or with slight flats at poles, are the most used steel tumbling materials. Used on flat and gently curved surfaces. Sizes: 3/32" through 5/8" diam.



DIAGONALS are useful for getting into angles such as this parachute buckle casting. Diagonals are usually made in sizes ranging from 1/16" through ¼" diam.



CONES have the ability to burnish depressions, joints and sharp curves. Sizes range from ⅛" through ½".



OVALBALLS combine action of two different size balls in one unit. Less often used, they are bean-like in shape made in sizes ⅛", 3/16" and ¼".

Small metal parts can be barrel finished by many different methods, ranging from simple self-burnishing in a dry barrel to carefully engineered blends of abrasives, stones and liquid. Here is a presentation on barrel finishing with steel balls and special shapes, pointing out methods, materials and process details.

OF all the manufacturing processes incorporated into industry's production lines, few have been as infrequently or as incompletely reported as barrel finishing. Despite this comparative dearth of information, the process has won an ever-increasing acceptance. It is well adapted to mass production work and has solved many finishing problems.

Barrel finishing requires less time and produces surface finishes far superior to those usually obtained with more commonly used hand finishing methods. These economies are possible in almost any size plant where deburring and/or cutting-down and the burnishing of parts is an essential operation.

Most often used for the surface finishing of common ferrous and non-ferrous metals, it is also successfully used for the finishing of certain plastic parts. Of late, the process has proved very useful in finishing powdered metal parts.

In principal, barrel finishing is a very simple process. Briefly, it is an operation employing the use of hard steel or abrasive materials as a surface finishing medium in a lined or unlined metal barrel. Into this bar-

PINS are useful because they probe into corners, recessed lettering, filigree or other surface detail. Sizes include: 1/16" x 9/32", 1/16" x ½" and ⅛" x ⅜".

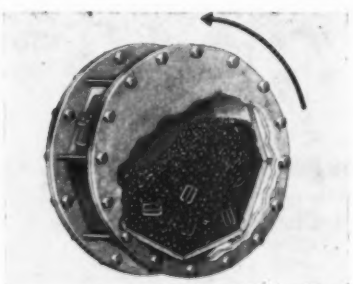
How to use STEEL BALLS AND SHAPES for barrel finishing

By R. M. TERRY*

rel are placed die castings or other small metal parts together with soaps, solvents, compounds or other chemicals and water. The metal barrel revolves, causing the tumbling materials to produce some predetermined finish on the enclosed parts.

Despite some claims to the contrary, barrel finishing is an industrial art rather than a science. It is scientific only to the extent that years of experience have produced barrel designs and tumbling materials which produce known results under certain conditions, but since each part to be finished invariably presents its own problems, solved only by experimentation and the fine hand of an experienced barrel finishing craftsman, the process can hardly be called an exact science. Our own engineers have always considered it advisable to make laboratory runs of some sample parts to determine proper barrel speed, tumbling material mixtures and other operating essentials before making final recommendations for production line barrel finishing operations. Occasionally it is necessary to prescribe special mixtures of tumbling materials, along with special barrel operating techniques for each sample part submitted.

*Executive Vice President, The Abbott Ball Company.



VERTICAL TYPE tumbling barrel shown in cutaway view illustrates position of part within mass of tumbling materials. Wave-like form of materials during operation is typical.

The basic fundamentals of successful barrel finishing are well known to the manufacturers of processing media. For the most efficient operation, the barrel and the tumbling materials must complement each other. Too often this is overlooked by inexperienced users. The resulting failures can be unfortunate and create an unfavorable, though unjustified, opinion of the entire process. The wisest course is to abide by the findings of an experienced, impartial barrel finishing authority who will test run sample parts and make specific recommendations.

Tumbling barrels are produced in many sizes and shapes, but since we are here concerned with the use of steel balls and shapes as a barrel finishing medium, we shall consider only those barrels intended for use with this material.

Barrels intended for use with metal tumbling materials are usually of heavy construction. The most popular models rotate on a horizontal axis and are octagonal in shape. Of these, the so-called high, vertical design is best-suited for all around use and efficiently performs the greatest number of jobs. A second design, featuring a barrel which extends along the length of the axis and has a fairly small diameter, is best suited for handling long parts which do not conveniently fit the narrower, larger diameter barrel.

The high, vertical design concentrates tumbling pressures within a relatively narrow space as illustrated in the cutaway views. This pressure, essential to successful operation, is applied directly to the parts to be finished and is not dissipated over a wide area. To produce these pressures the load of steel balls and shapes will range from 300 to 800 pounds in a single compartment barrel.

continued next page

Barrel finishing with steel balls and shapes is quite unlike tumbling with abrasive materials and offers definite advantages which are not to be had in other types of media composed of sand, quartz chips, pebbles, porcelain and similar substances.

The best and most efficient abrasive materials are manufactured especially for tumbling. They produce a surface finish by cutting or abrading action. The degree and extent of this action is governed largely by the coarseness of the abrasive. It is also controlled by various solvents, compounds and chemicals which are added to the tumbling mixture.

Finishes range from coarsely ground surfaces to finely honed effects. In every instance, however, abrasive removes some of the material from the part which is being finished. In doing this, the so-called burnishing and the conventional cutting-down materials are themselves destroyed or at least made useless.. As a consequence, very few abrasive tumbling materials of this type can be used for many finishing cycles. They must be replaced frequently.

Steel or other metal shavings and chips, salvaged from scrap bins are sometimes used in barrel finishing operations as are rejected bearing balls. In both instances, their use is hazardous at best. Scrap shavings or chips are purely abrasive in action and cannot be properly controlled during the barrel's operation. Rejected bearing balls are to be avoided because the very flaws which caused their rejection might make deep scratches and nicks on parts to be finished. Neither shavings or rejected balls should be classified with steel balls and shapes produced specifically for barrel finishing.

Burnishing or cutting

Steel balls and shapes are most commonly associated with barrel burnishing, but they are equally effective for de-burring and cutting-down operations when used in conjunction with certain abrasive materials. The steel balls and shapes used for this operation differ from those used in burnishing in that they are not hardened or tempered and are generally referred to as steel balls and shapes in the soft state.

For the de-burring or cutting-down operation these "soft" balls and shapes are placed in an unlined barrel together with a suitable abrasive. Sand is the abrasive most commonly used. The balls and shapes serve to speed the cutting action and provide uniform contact on irregular

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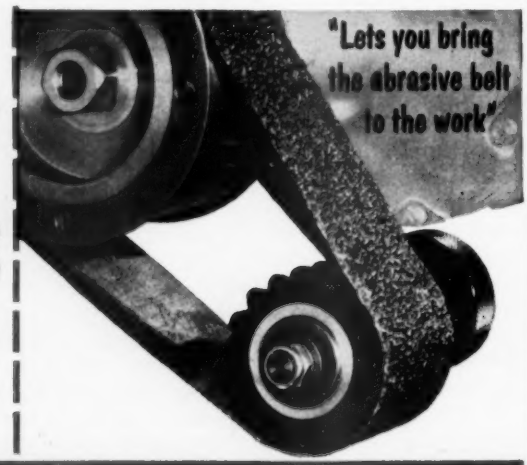

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areas which would not be touched if the parts were tumbled in a mixture of sand or abrasive and water alone.

The length of the de-burring or cutting-down run depends on the original condition of the parts as well as the final degree of smoothness required. Sometimes results are secured in a relatively short time but it is not uncommon to run certain types of castings for many hours. The net result is to remove an equal amount of material from the entire surface of the part being processed.

If burrs are extremely heavy, many hours of tumbling may fail to remove them although the overall size of the part will gradually decrease. Under normal circumstances and with the proper care between runs, the balls and shapes will last for a considerable period of time.

In burnishing, the barrel is lined with hard rock maple or neoprene panels. The steel balls and shapes are hardened and tempered. The finest type is manufactured by the same precise methods that are utilized to produce fine bearing balls. Properly handled, they will last indefinitely and can produce fine surface finishes.

The development of scientifically designed burnishing shapes about 1910 and the creation of the vertical tumbling barrel are among the scientific approaches to barrel finishing. The action of the narrow, vertical barrel has been fully explored and is predictable. The results produced by each of the shapes are also well known. But like all other methods, this method of barrel finishing requires the knowledge and touch of the craftsman in composing the proper mixtures of balls, shapes and soaps to produce a desired result. The mixture's composition is usually determined by trial and experimentation in test operations. Most manufacturers of steel burnishing ma-

continued next page

The PROTECTION of ALUMINUM

Drawing courtesy of Piasecki Helicopter Corporation, Morton, Pennsylvania

THE H-21 Piasecki Tandem Helicopter—the "Work Horse"—is ideally suited for rescue work in areas inaccessible by other means, and in all kinds of rough weather.

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Selecting the right shapes

The burnishing action produced by steel balls and shapes differs from other abrasive tumbling materials in that less metal is removed from the part being finished. Surface finish is acquired from a combination of a partial ball peening action and a partial metal removal action which work hardens the metal. In this way the pores of the metal are effectively closed up and a high luster is acquired. The process also increases the metal's resistance to corrosion.

The best steel balls and shapes are usually made of carbon steel, deep hardened, tempered and polished to a mirror-like glass-hard finish. Balls may, in some instances, have a slight flat at each pole, but this will not affect burnishing abilities. Balls from the basis of most operations and are generally supplemented by shapes.

Steel shapes vary in size and design, but experiments prove conclusively that four basic shapes and two types of ball will make effective burnishing contact on virtually every type, size or form of part to be finished. These balls and shapes and their applications are usually catalogued as:

1) **Balls** which provide a a roll-down kind of burnishing action on large flat or gently curved surfaces. Perfect spheres are used for finest finishes. Balls with flat poles are more commonly used where high finish is not too important.

2) **Diagonals** which are designed to burnish hard-to-reach corners and sharp angles. Their cylindrical

form gives them a rolling action similar to the ball.

3) **Cones** are intended to work channeled or grooved parts and long joints where curved and flat surfaces meet. They work effectively in countersunk depressions also and combine the action of a diagonal and a wheel whose action is similar to a ball.

4) **Ovalballs** are less often used and combine the actions of two different size balls in one unit. They are best suited for uses where rounded forms are joined by short, curved joints. The small, rounded ends have a wiping effect on these joints while the larger center sections provide the added weight and coverage of the large ball. They may be used in mixtures or alone.

5) **Pins** are used for pinpoint probing into sharp crevices, filigree, surface etchings and similar conditions. Pointed at both ends, they quickly burnish these hard-to-clean spots. They are best applied in a mixture with balls and other shapes to improve overall burnishing action.

Factors that affect finish

Cleanliness is essential to successful barrel burnishing with steel balls and shapes. All grease and foreign matter must be rinsed from parts to prevent it from being rolled into the part during the operation. In like manner, the barrel and and burnishing mixtures must also be kept very clean. Rusted or pitted burnishing materials will scratch the work and will not produce a lustrous finish.

A number of additives have been developed during recent years which are intended to assist the balls and shapes in the burnishing operation. As a rule, their use is dictated by the finish or color desired, the chemical content of the water and other factors. In general, however, a soapy water solution will serve to provide the lubrication necessary and for this purpose a mild, chip soap is used.

If necessary, a water softener such as trisodium phosphate

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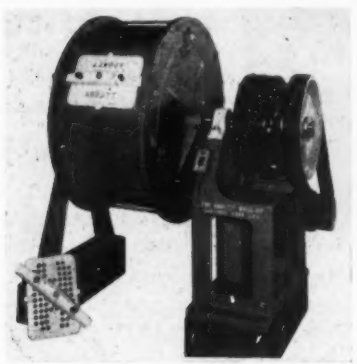

TYPICAL HIGH, Vertical type tumbling barrel designed for both burnishing and deburring operation.

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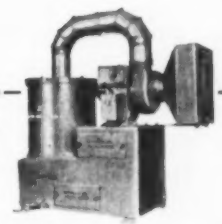

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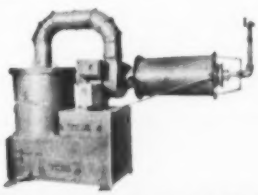

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in order to insure that soap chips' effectiveness as a lubricant is constant. In hard water, an indeterminate amount of the soap's lubricating efficiency is lost with a corresponding drop in the effectiveness of the entire operation.

Correct barrel rotating speed is an important factor in all barrel finishing. In burnishing, it seldom exceeds 35 RPM and sometimes is as slow as 10 RPM. Average speeds are approximately 18 to 20 RPM for most parts. This produces the rhythmic, uninterrupted "flow" of burnishing materials.

Excessive barrel speed sets up a centrifugal force which causes parts to fly out of the mass of materials. This decreases burnishing action and often damages the parts. Fast barrel speeds do not speed up the operation. The most effective barrel speeds are best determined by experimentation.

The volume of burnishing materials required for a given job may vary. A rule of thumb prescribes that twice the volume of burnishing materials be used to the volume of work. This usually provides the correct cushion of balls and shapes between the parts to be burnished.

To finish special units correctly, the ratio of shapes to parts may have to be increased to prevent parts from contacting each other. It is a mistake to economize on materials at the expense of the parts to be finished. The barrel should always be loaded with materials to somewhere near half its capacity if it is to produce a satisfactory burnishing action.

Proper care for steel balls

Steel balls and shapes can be used over and over, if they are given the proper treatment between operating runs. In this respect, they offer the user real economy.

To keep steel balls and shapes in their original condition between operations they should be covered with a soap and water solution either while in the barrel or in storage.

If unused for long periods, they should be covered with a rust preventive which should, of course, be completely removed before the material can be cleansed in one operation by tumbling for about 15 minutes in a soapy water solution, followed by two or three thorough rinses.

Slightly pitted balls and shapes can be refinished by running them in an unlined barrel filled to the load level with water to which has been added 5 to 10 pounds of fine Vienna lime. Deeply pitted materials must be tumbled with a harsher abrasive such as fine, sharp sand before tumbling in Vienna lime.

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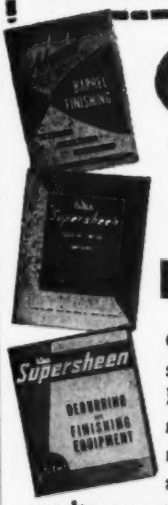

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Diamond wheels that are used to cut powdered metal clutch plates:

1 DIAMOND WHEELS are used at Wellman for cutting grooves in silicon alloy clutch plates. They are used in sizes: 3 inch 1/8 and ¼ thick, 8 inch ½ and ¼ thick.

2. TRUING THE WHEEL is a process of restoring the wheel to running truth. Two wheels are trued at the same time, pancaked together. When the parting line between the two wheels is no longer visible, the truing operation is complete.

3. THE WHEELS are dressed by wire brushes. The brushes remove some of the brass matrix leaving the diamonds sticking up for better cutting action.

How to get MORE CUTTING ACTION from diamond wheels

A NEW brushing method that increases the cutting action of used diamond wheels by 80 percent is now in use at the S. K. Wellman Company, Cleveland, Ohio.

This method, worked out by Wellman Engineers in collaboration with the Osborn Manufacturing Company, utilizes a wire brush to remove some of the brass matrix, leaving the industrial diamonds sticking up for better cutting action, thus giving each wheel added life.

This new method takes on added importance in view of the present government diamond allocation program. Since there are not enough diamonds available to fill present demand, it is of utmost importance that each diamond wheel be used in the most efficient manner to obtain maximum output; and that the wheels be made to last as long as possible.

The diamond wheels are used at Wellman to cut grooves in silicon alloy material used for Wellman "Velvetouch" clutch plates. Various sizes are used: 3 inch diameter, ⅛ and ¼ inch thick; and 8 inch diameter, ⅛ and ¼ inch thick. The outer rim is bonded ⅛ or ¼ inch thickness of industrial diamonds in brass matrix, Figure 1.

In service, the wheels wear down to a crown shape and must be squared up, or "trued and dressed." "Truing" is the process of restoring the cutting face of a wheel to running truth. "Dressing" is done for the purpose of improving the wheels cutting action. Dressing the wheel is primarily a cleaning or "resharpening" operation by removing any load, or minute amount of bond between the diamond particles. This job is done by the wire wheel brushes.

In "truing" or squaring up the diamond wheels, a brake

continued on page 71

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IN DESIGNING for pneumatic operation of equipment, the air engineer can now choose the method of valving he prefers — and still have all the advantages of integral valve and cylinder construction.

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If he prefers to use momentary contact low voltage control, standard or explosion-proof, Bellows has it. If he prefers 110 volt maintained contact for interlock with established electrical circuits, Bellows has it. If he prefers to control his pneumatic circuits manually, Bellows has it. Or should his designs call for full pneumatically controlled operations, Bellows offers a choice of two control systems.

Basic to all valving arrangements is the time-proven Bellows four-way directional slide valve with its integral controls for regulation of piston rod speed. Basic, too, is the single air connection which may be flexible hose, and which does away with multiple piping. It is in the methods used to shift the directional slide valve that this new flexibility in air control becomes so apparent.

All Bellows Air Motors, with any integral valve control, are available in five bore sizes: 1¼", 1¾", 2½", 3⅜" and 4½" and in stroke lengths up to 48". A wide range of mounting styles further adds to the flexibility of this compact, self-contained power unit.

This new 36 page, three color booklet tells the complete story. It is free on request. Ask your local Bellows Field Engineer for a copy, or write direct to Dep't PMM-853 The Bellows Co., Akron 9, Ohio. Ask for Bulletin CL-50.

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PROCESSES

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Powdered Metal Parts for Industry: **No. 145**
An informative brochure from the Powdered Metal Div. of Kwikset Locks, Inc., is entitled, "Powdered Metal Parts for Industry."

MATERIALS & EQUIPMENT

Die-Forge Casting Machine: **No. 146**
Detailed description of a new "die-forge casting machine" which features an exclusive 200-ton hydraulic clamping mechanism has been issued by Lewis Welding & Engineering Corp. Detail photos, drawings and spec lists give pertinent information concerning the 2-stage injection system, the hydraulic power unit, floor plan, dimensions and other features. Automatic compensation for expansion of heated dies is a special feature of this cold chamber die casting machine.

Comprehensive Metal Hose Catalog: **No. 147**
A 48-page catalog from Titeflex, Inc., gives comprehensive data on metal hose & is said to be the first to furnish charts on frictional losses vs flow rates. A specification page designed to help in ordering metal hose is a special feature.

Applied Magnetics: **No. 148**
A new, technical house organ published by Indiana Steel Products Co. contains material to aid engineers in design & development of permanent magnets. Name of the publication is "Applied Magnetics," and it will cover such fields as electronics, instruments, control equipment, generators & motors, magnetic chucks, conveyors, vending equipment, games, toys, compasses, etc.

Four-Way Hydraulic Valve: **No. 149**
A new hydraulic 4-way valve with ball detents to hold the valve piston in any given position is presented by Rivett Lathe & Grinder, Inc. in a new 28-pg. catalog.

Cemented Chrome Carbide: **No. 150**
A technical report on Carboloy grade 608 cemented chrome carbide, a comparatively new powdered metal that is highly resistant to corrosion & erosion, has been issued by the Carboloy Dept. of General Electric.

Industrial Gas, Electric & Oil Furnaces: **No. 151**
The full range of Knapp industrial furnaces for melting, heat treating & other uses is presented in a new brochure issued by James H. Knapp Co. Gas, electric & oil furnaces are covered in the 16-pg. bulletin which includes many types of non-ferrous melting furnaces, carburizing, annealing & normalizing furnaces, and aluminum alloy treatment furnaces.

Shell Molding Machine: **No. 152**
The Shalco Shell Molding Machine is presented in a new brochure issued by Shalco Engineering Corp. This is a low-cost machine for producing high quality shell molds.

Investment Casting Supply Catalog: **No. 153**
From Alexander Saunders & Co. has been received a new catalog of equipment & supplies needed for investment casting. Materials for each step in the process are included: wax pattern making, investing, casting, melting & finishing. Special equipment included in the catalog is a new type of wax injection press.

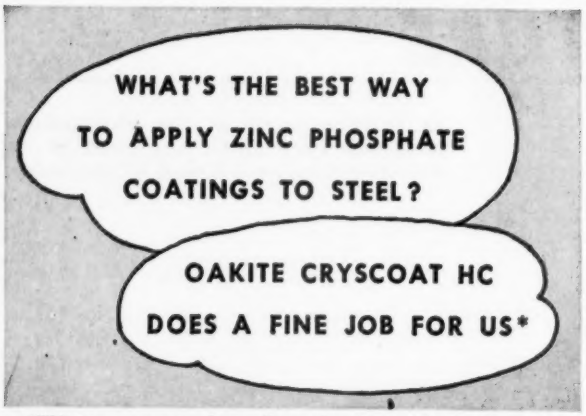
High Strength Aluminum Alloy: **No. 154**
An aluminum casting alloy having high yield strength is the subject of a bulletin on Tenzaloy published by American Smelting & Refining Co. Permanent mold castings in this alloy are reported to have yield strength up to 27,000 psi after 10-14 days aging at room temperature.

Closed-Flame Gas-Oil Burners: **No. 155**
A new catalog on Eclipse Fuel Engineering Company's closed flame gas-oil burners has been made available by the company.

Corrosion Resistance of Copper & Copper Alloys: **No. 156**
Results of 27 years of lab research & field study have been consolidated into a new booklet "Corrosion Resistance of Copper & Copper Alloys" published by American Brass Co. Publication explains chemical & physical nature of corrosive attack; includes tabulation of relative corrosion resistance of principal copper & copper-base alloys in contact with 183 different corroding agents.

How to Run Production Test of Metal Abrasives: **No. 157**
A technical brochure issued by Harrison Abrasive Div. of Metals Disintegrating Co., Inc., is titled

continued next page



*This comment came from a Pennsylvania munitions maker, who added that Oakite CrysCoat HC has put an excellent zinc phosphate coating on 385,000 shells with "absolutely no trouble . . . maintenance and control are very easy."

The Oakite CrysCoat HC coating on steel products—such as artillery shells, rocket fins, auto parts, etc.—weighs more than 200 milligrams per square foot. It more than meets the requirements of U. S. Government Specifications:

JAN-C-490, Grade 1 57-O-2C, Type 2, Class C
PA-PD-191, Rev. A

The Oakite CrysCoat HC Process for preparing steel for painting—either in spray-washing machines or in tanks—has five big advantages:

1 The heavy CrysCoat HC coating forms a strong foundation for the lasting adhesion of paint. *See page 5 in free booklet.*

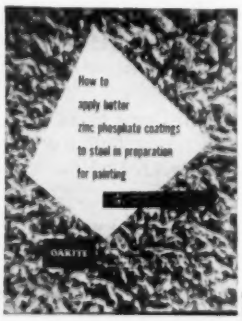
2 The heavy coating gives excellent protection against electrochemical corrosion. *See page 7.*

3 The CrysCoat HC Process is easy to control. Only one material is used for make-up and up-keep. No accelerators, starters, toners or other additives are needed. Only one simple type of titration is used. *See page 9.*

4 The CrysCoat HC reaction produces relatively little sludge and scale. *See page 10.*

5 Stainless steel is not necessary for all parts of the equipment. *See page 11.*

FREE For complete information, mail the coupon for a copy of our 12-page illustrated booklet describing the Oakite CrysCoat HC Process.



SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

OAKITE PRODUCTS, INC.
34G Rector St., New York 6, N. Y.

Send me a FREE copy of *"How to apply better zinc phosphate coatings to steel in preparation for painting."*

Name _____

Company _____

Address _____

For additional information Circle No. 56 on the Reader Service Card

USEFUL LITERATURE — cont.

"How to Run a Production Test of Metal Abrasives". It includes sample data sheets, explains how to evaluate test results, gives test procedures. cedures.

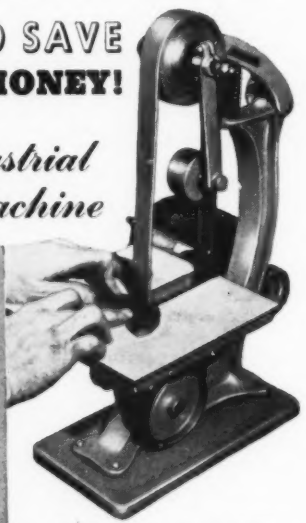
Production Heat Treating Furnaces: **No. 158**
A brochure from Harper Electric Furnace Corp. offers nine types of furnaces for production heat treating, including continuous brazing, sintering, bright annealing stainless wire, melting in crucibles, annealing and many others.

Die Casting Die Lubricant: **No. 159**
A new type of die casting die compound for use in the production of zinc and aluminum die castings has been introduced in a piece of literature available from Fiske Brothers Refining Co. The lubricant is Fiske's 231 Die Casting Compound. pound.

Toolholder Uses Carbide Blanks: **No. 160**
Metal Carbides Corp. has published a 4-pg. circular describing new style Klamp-Lok toolholder that utilizes standard carbide blanks & mechanically clamps them into the tool holder in a horizontal position.

Heat-Treating Furnace Installations: **No. 161**
A new 8-pg brochure containing photos of outstanding installations of gas, oil & electric heat-treating furnaces is available from Lee Wilson Contracting Co. Illustrated are more than 14 furnace types for use with or without protective atmospheres.

18 WAYS TO SAVE TIME & MONEY!
with the
Mead Industrial Burring Machine



WOOD-PLASTIC-METAL

New circular explains, illustrates 18 ways in which the Mead Industrial Burring Machine saves time and money—also contains special Grit Guide. Every industrial plant needs this "Jack-Of-All Trades" machine. Your burring can be done in "free time"—install these machines by every machine tool which leaves burrs. Grinds, finishes both outside and inside cut-out openings. Immediate delivery in most cases. Write for the informative Money-Saving circular now.

MEAD SPECIALTIES COMPANY
4114 No. Knox Ave. Dept. DC 83, Chicago 41, Ill.

For additional information Circle No. 78 on the Reader Service Card

Casting Impregnation with Polyester Resin: **No. 162**
In a 4-pg leaflet, Multiplastics presents complete data on the proper impregnation of castings with polyester resins. Of interest is a tabulation comparing properties of 8 different types of impregnants.

FINISHING

Chatterless Deburring of Holes in Aluminum: **No. 165**
A new tool for chatterless deburring of holes in aluminum when used in stationary or portable drills is subject of literature from The Deburrer Co.

Flexible Shaft Machine for Finishing Light Metals: **No. 166**
Complete line of flexible shaft machines for finishing operations such as grinding, sanding, wire brushing, buffing, polishing & filing on light metals is the subject of a new bulletin from Stow Mfg. Co. Said to be especially useful for getting into corners and insides of castings for rapid finishing.

Simultaneous Pickling & Phosphating: **No. 167**
A phosphoric acid pickling process that pickles & phosphate treats in one operation is described in literature from Nelson Chemical Co. on their Prep-pik-1 process.

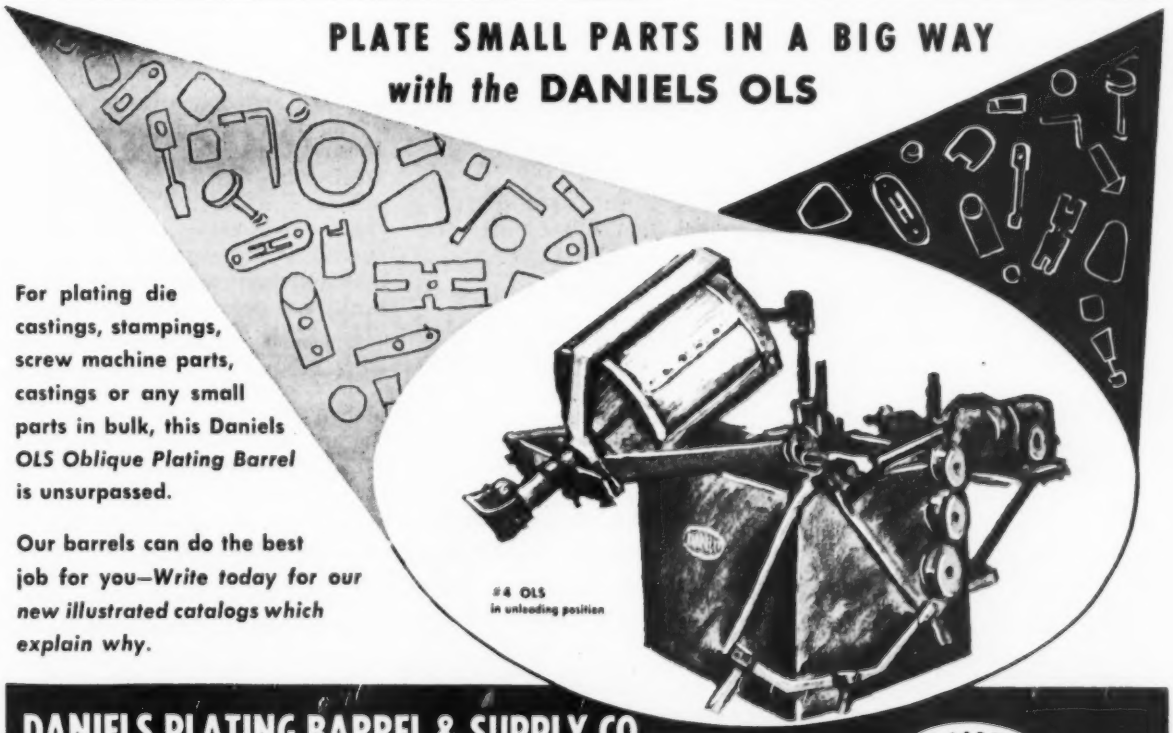
Deep Hole Drilling: **No. 168**
An automatic deep hole drilling attachment is presented in a leaflet from The General Pacific Corp. It is said to be adaptable to most makes and models of drill presses.

Production Deburring of Soft Metals: **No. 169**
Fast production deburring of soft metal parts using either a continuous rotating process or stationary clamping arrangement, has been announced in literature on two standard Maizo Blast machines from Modern Industrial Engineering Co. Maize, or similar soft material, is blasted against the parts to deburr aluminum, mild steel or other metals.

Impregnation of Porous Castings: **No. 170**
A comprehensive report on the sealing of porous castings to make them gas or liquid tight has been made available through the Seal Cast Co., Inc. The report gives details of impregnation methods, compares custom impregnation with an in-plant installation and analyzes costs, amortization of equipment and results. Of particular interest to foundrymen will be the section dealing with grain refinement in an attempt to overcome the porosity problem in the foundry.

New Pickling Compound Replaces Hydrofluoric Acid: **No. 171**
A new, dry powdered material designated as Actane 33 has been developed by Enthone, Inc. to supplant hydrofluoric acid in the finishing room. The new product contains soluble fluorides, penetrating and dispersing agents. In combination with sulfuric acid Actane 33 is used for etching aluminum and with nitric acid produces a mixture that will remove silicon and copper from aluminum and produce a clean white surface.

PLATE SMALL PARTS IN A BIG WAY
***with the* DANIELS OLS**



For plating die castings, stampings, screw machine parts, castings or any small parts in bulk, this Daniels *OLS Oblique Plating Barrel* is unsurpassed.

Our barrels can do the best job for you—*Write today for our new illustrated catalogs which explain why.*

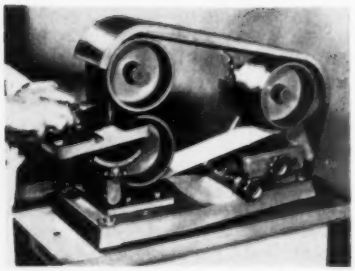
DANIELS PLATING BARREL & SUPPLY CO.
MANUFACTURERS and DISTRIBUTORS
Electroplating and Polishing Equipment and Supplies
129 Oliver Street, Newark 5, N. J. • Tel. MArket 3-7450

DANIELS

For additional information Circle No. 53 on the Reader Service Card

NEW PRODUCTS

For additional information on these products circle key number on reader service card bound in this issue.



SHARPENING CARBIDE TOOLS . . . using an abrasive belt

Based upon the use of low-cost abrasive paper belts and a new type belt machine the wider use of carbide tools throughout the metalworking, woodworking, and plastic industries will be possible.

The major significance of the new method is that it simplifies the job of sharpening carbide tools and reduces overall costs — yet produces a tool edge better than that obtained in most plants with older grinding methods.

The new method is intended to supplement, and in many cases, replace the conventional diamond wheel method, especially where the initial cost of diamond wheels is prohibitive. The new method of sharpening largely eliminates the need of skilled diamond wheel operators and makes standard shop practice satisfactory. Design of the sharpening machine is such that both the angular surfaces and the flat top can be ground for greater tool mileage.

Minnesota Mining and Mfg. Co.

For more information Circle No. 196 on the Reader Service Card

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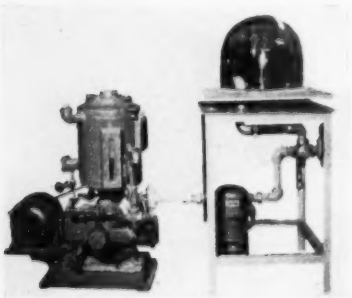

TAILOR MADE VACUUM UNITS . . . for the investment casting industry

To de-aerate the freshly made investment slurry and to remove air from molds after the slurry has been poured over the wax pattern special vacuum units for industrial casting are now being made to order.

The unit for this work consists of a Beach-Russ type vacuum pump, Stay-New Filter, three-way air valve, steel table with jiggle plate and a rubber mat. The bell jar is made of plexi-glass and is sold separately. Both single and multiple station units are built.

Alexander Saunders & Co.

For more information Circle No. 197 on the Reader Service Card

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PRESSED STEEL FURNACE POTS . . . metalized for longer life

"Metalized" pressed steel pots for heat treating furnaces are reported to give up to 200 percent longer life than ordinary pressed steel containers.

These new pots are being manufactured with three different types of "metalized" coatings for temperatures up to 1500F, from 1500F to 1700F and for over 1700F.

The resistant coatings are said to protect the pressed steel surfaces against heat oxidation and scaling caused by hot gases encountered in high temperature heat treatment work. All standard put sizes are available from stock.

Eclipse Fuel Engineering Co.

For more information Circle No. 198 on the Reader Service Card

NEW DIE CASTING MACHINE
. . . uses water as hydraulic fluid

Made in a wide range of sizes from 28 to 700 tons locking pressure, a new Italian made die casting machine is now available on the American market.

Features claimed for the machine are:

Hand or foot push buttons for individual operation or fully automatic cycling.

Hydraulic central ejector.

Hand lever or electric control for hydraulic core pullers and ejectors.

Variable speed of opening and closing operation.

Speed regulator for injection plunger.

Pressure adjustment for injection plunger.

All machines possess two interchangeable shot positions and some have supporting adjustable wheels for the mobile platen. All machines have demountable tiebars and hard-chromium plated pistons.

Kelvin Systems Corp.
For more information Circle No. 199 on the Reader Service Card

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SPEED UP PRODUCTION
. . . with small punch presses

The use of punch presses plays an important part in the high rates of productivity achieved in this country. It has been estimated that 85 percent of all production is done on these units and that, of the presses installed, 50 percent are under ten tons capacity. Small powder presses are, therefore, in integral part of American production.

By proper arrangement of a number of small units, that is bench mounted units, it is possible to set up very high speed production lines with progressive dies set up in individual small presses so that only a single operation is done per machine.

Through the use of bench mounted four ton presses, many operations that might require a very large massive set-up can be reduced to a series of simple single station operations. Any necessary modifications can often be made by changing a single die set at relatively low cost.

Kenco Mfg. Co.
For more information Circle No. 200 on the Reader Service Card

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SINTERING WORK HOLDERS
. . . in high temperature ceramic

A new ceramic, A1SiMag 539, is reported to be an excellent material for fixtures, jigs, and work holding devices for fast production line handling of high temperature sintering, brazing, welding, electronic heating and flame polishing. The ceramic is a relatively fine grained silicon carbide material. Where high temperatures are involved or where rapid thermal changes occur, this material has superior properties. Test discs of this material will be sent without charge.

American Lava Corporation
For more information Circle No. 201 on the Reader Service Card

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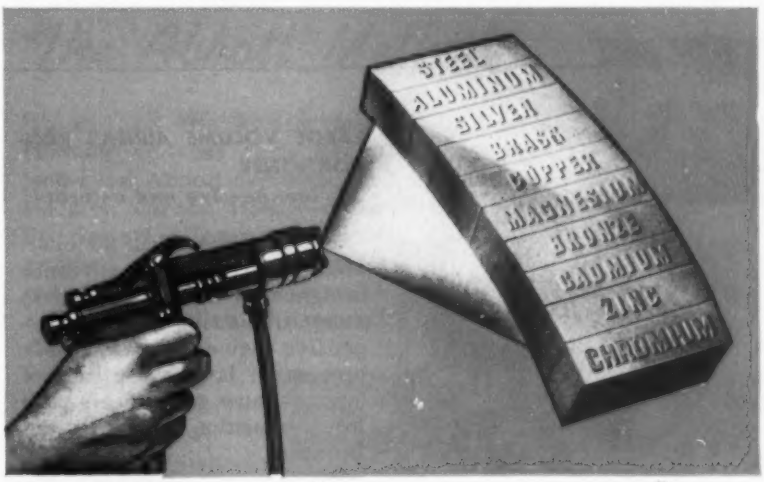


ADHERES to almost any metal
INVISIBLE on all of them

DULAC Clear Universal Lacquer #462—a *single* water-white lacquer with remarkable adhesion to practically *all* metals. Finishing shop after finishing shop* reports that this M & W lacquer can be applied with *equal* success to just about any metal—and that it's invisible when applied. AND . . . tests conducted by an unbiased laboratory show that DULAC #462 withstands salt spray and weatherometer tests for longer periods than ordinary lacquers.

DULAC #462 forms a tough, lasting protective film that resists heat, cold, weather, stain, perspiration. It cuts *inventories*, because one lacquer handles so many metals. It cuts *production time*, because it dries out of dust in 5 to 10 minutes . . . hard in an hour. Applied by spray or dip.

*Names on request

PIONEERS IN PROTECTION — OUR 78th YEAR — M & W CO 1874

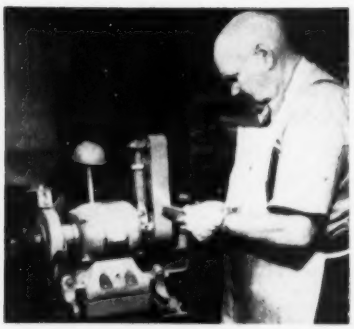
For complete information, write for Technical Data Bulletin #110.

MAAS & WALDSTEIN CO. 2121 McCARTER HIGHWAY NEWARK 4, NEW JERSEY

Midwest Div.: 1858 Carroll Ave., Chicago 12, Ill. • Pacific Coast Div.: Smith-Davis Co., 10751 Venice Blvd., Los Angeles 34, Cal.

MANUFACTURERS OF INDUSTRIAL FINISHES

For additional information Circle No. 54 on the Reader Service Card



PORTABLE GRINDING BELT ATTACHMENT

. . . for one of a kind or short run jobs

Named the ADAPT-A-BELT a new portable belt grinder is now on the market. The unit is a light weight steel supporting member with a versatile clamping device that allows its use on a wide variety of machine tools such as bench grinders, lathes, drill presses, milling machines, etc.

Advantages of the Adapt-A-Belt include the use of dynamically balanced rubber covered contact wheels in various diameters, widths, and durometer, as well as, soft or hard cloth wheels. The grinder is equipped with a tracking mechanism and an efficient belt tensioning device. Two models use belts of one or two inch widths. Grinding can be done either against the contact wheels or on the unsupported belt.

Curtis Machine Corp.

For more information Circle No. 202 on the Reader Service Card

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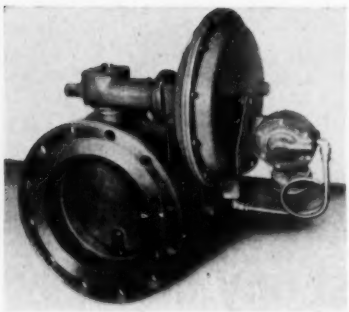

LARGE VOLUME AIRGAS PROPORTIONER

. . . inexpensive and accurate

A relay controlled, air operated, cross connected governor designed to meet the need in many industries for an inexpensive device to accurately proportion large quantities of low pressure gas and air used for combustion has been announced.

The proportioner may be installed in either a gas or an air line of any standard pipe size ranging from 4 through 16 inches. It consists of a butterfly valve operated by an air motor and controlled by a relay receiving pressure impulses from both the gas and air lines. The valve is nondirectional so that gas or air may be passed through it in either direction. The proportioner may be mounted in either a horizontal or vertical run of pipe.

Capacities at a pressure drop of only 1 oz. per sq. inch range from 24,100 cfh of air for the smallest size to 385,000 cfh for the largest.

North American Mfg. Co.

For more information Circle No. 203 on the Reader Service Card

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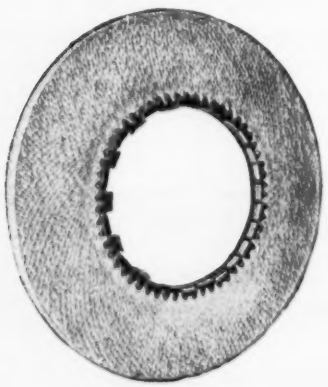

LONG-LIFE BUFFS

. . . have interlocked fibres

A new, exclusive manufacturing process called "permanizing" which the manufacturer claims will double buff life, is used on American's Bias Sisal Buffs, comprising the conventional type, the permanent steel center, and the new patented "centerless' type buff.

The "permanizing" process permanently locks together the fibres of the top-grade sisal fibre cloth woven to exact specifications and bias cut. This special process is said to reduce fraying, prevent excessive hardness, give a perfect finish and eliminate many grease wheel operations. Air-conditioned buff construction provides cooler running at faster speeds and increases machine output.

American Buff Co.

For more information Circle No. 204 on the Reader Service Card

AUTOMATIC SPRAY DECORATING MACHINE

. . . dial controlled for loading or dwell

A new, automatic, spray-decorating machine which is electrically dial-controlled for loading or dwell time and gun-spraying time, all within the tenth of a second, has been developed.

The machine can paint from zero to a 24 inch stroke. The air hold-down pistons are fully adjustable and automatically coordinated with the painting cycle. In stationary position the machine will cycle up to 3600 times per hour, probably faster than an operator could handle the parts.

Conforming Matrix Corp.

For more information Circle No. 205 on the Reader Service Card

VACUUM METALIZING UNIT

. . . for development and short-run work

The vacuum evaporation of metals to provide a metallic finish on metals, non-metals and fabrics has been established as a commercial process over the past ten years. Process equipment has generally been limited either to laboratory apparatus or to large production units. A new model is now available that is designed specifically for development and short run production work.

Priced at about one-third the cost of the large production scale equipment the new unit features a high-speed pumping system, the NRC rotary gas ballast pump which can pump water vapor without loss of pumping speed or capacity and without contamination of oil. All necessary instrumentation, including the new Alphatron Vacuum Gauge, is an integral part of the coater.

National Research Corp.

For more infrmation Circle No. 206 on the Reader Service Card

MARKING MACHINE

. . . operates on shop air line

Operating from standard air lines used in most shops and requiring only 75 psi this new machine provides essentially automatic production marking on plastic, metal or parts of other material. For tubular, cylindrical or round objects the parts roll down an inclined runway, are fed under the marking die by air pressure, than are marked and ejected.

The valve controlling the feed is actuated by each stroke of the marking machine. At the completion of each stroke another valve is opened providing air pressure to remove the marked part.

A roll leaf or color transfer taped feed is carried over the part to provide the color. Marking speeds of 40 or more pieces per minute are possible.

The Acromark Co.

For more information Circle No. 207 on the Reader Service Card

Good Barrel Finishing Costs Less with The Abbott Method

It's a fact! The Abbott Method of Barrel Finishing reduces costs because it features long-lived Abbott Burnishing Shapes. Made of selected carbon steel — deep hardened — tempered and polished to a mirror-like glass hard finish, Abbott Shapes make efficient contact on all sizes and designs of stampings and castings. Abbott Burnishing Shapes last longer, burnish more parts and cost less in the long run. Used in Abbott Vertical Barrels they make an unbeatable barrel finishing combination!

For Proven Performance . . . use The ABBOTT METHOD.

Improved Abbott Barrel!

Self-contained! Precision speed control! Color dynamic! Write for details . . . quick!

ABBOTT

THE ABBOTT BALL COMPANY
1084 NEW BRITAIN AVE.
HARTFORD 10, CONN., U. S. A.

For additional information Circle No. 51 on the Reader Service Card

If your product should be . . .

small in size...

but high in tensile strength

MH CHROMIUM-NICKEL PRE-ALLOYED POWDERS

Combined with iron powders, Metal Hydrides' chromium-nickel pre-alloyed powders will assure a maximum of tensile strength with a minimum of size in your product. Equally important is the fact that the ultimate in results and utmost satisfaction can be achieved with a very low percentage of MH chromium-nickel pre-alloyed powders.

Write now for complete information of iron powders with alloys of varied chromium-nickel contents. Your inquiries will receive prompt, interested attention. Specify Bulletin 800-A.

MH **METAL HYDRIDES**

INCORPORATED

20 CONGRESS ST., BEVERLY, MASS.

NEW PRODUCT BRIEFS

118. A NON-TOXIC, non-flammable water emulsion for use as a shell mold release agent is available from the R. M. Hollingshead Corp.

119. AIR-HYDRAULICS, INC. has brought out a small air operated hammer for light stampings, forgings, coining, riveting, etc. The hammer can be mounted at any angle, including upside down. At 100 psi air pressure from 50 to 120 strokes per minute are possible.

120. A LOW COST DUPLICATING attachment for engine lathes with up to 13 inch swing has been developed by Lehigh Foundries, Inc. The duplicator is designed for short run jobs, but is of heavy enough construction to stand steady three shift operation.

121. SIZE CONTROL CO. is marketing a universal handle for go, no-go gauges. With a set of eight handles gauges from 0.010 to 0.750 can be accommodated.

122. A PORTABLE DE-MAGNETIZER, the Jiffy-Rase, that operates from any 120 volt AC outlet has been developed by Rason Mfg. Co. The unit is most useful for demagnetizing tools and small steel parts.

123. A FULL LINE, comprising 47 sizes, of wire thread inserts is announced by Heli-Coil. The set contains five in the automotive spark plug series, 17 in the National and Unified Coarse Thread series, six in the National Pipe Thread series, 15 in the National and Unified Fine Thread series and four in the Aviation Spark Plug series.

124. A MIDGET GRINDER is being marketed by Nu-Jet Products; said to be the smallest and lightest pencil type grinder on the market. The grinder is air powered and can develop up to 110,000 rpm for fine grinding and polishing.

REFERENCE MATERIAL

Catalogs and data offered free in this month's ads; to receive copies circle number on reader service card.

2. THE HOWS AND WHYS of the Mercast Process are described in bulletin No. 706 from Alloy Precision Casting Co.

8. A SINGLE UNIT or a central station installation, are described and illustrated in catalogs and engineering data sheets from The Aldrich Pump Co.

11. INVESTMENT CASTINGS that save money by eliminating machining are described in literature from Crucible Steel Co. of America.

13. HOW TO DESIGN for die castings and the advantages of using die castings, are described in a file folder published by Hoover Co.

16. USE OF HEAT EXCHANGERS by the precision molding industries is described in bulletin 1.1K5 from the Kewanee-Ross Corp.

17. STANDARD OR SPECIAL die casting machines, a complete line, are described in an illustrated catalog from Kux Machine Co.

18. DETAILS and SPECIFICATIONS of a new line of die casting machines are given in a bulletin issued by Lewis Welding & Engineering.

20. AN ENGINEERING REPORT on non-flammable hydraulic fluids is available from Monsanto Chemical Co. in their bulletin.

26. INVESTMENT CASTINGS by the Intricast Process is described in an 8 page booklet, MP-531, from Thompson Products,

27. THIRTY SIX PAGES, three colors, tells the story of air devices manufactured by The Bellows Co.

30. ALLOYS OF CHROMIUM, nickel and iron made by powder metallurgy are described in bulletin 800-A of Metal Hydrides, Inc.

32. DIMENSONING DIE CASTINGS is subject of a booklet offered by Newton-New Haven Co.

33. SPECIALIZED DIE MAKING service for the die casting and permanent mold industries is described in an illustrated brochure from Permanent Mold Die Co., Inc.

36. CORROSION RESISTANCE, paint base or final finish all are described in literature from Allied Research Products, Inc.

37. ALODINE FOR PROTECTION of aluminum surfaces is described in process data sheets available from American Chemical Paint.

42. SMALL DIE CASTINGS — sizes, alloys, design limits — reviewed in folder from Gries Reproducer.

43. THE HENNING MESSENGER and a fact-filled booklet on zinc base die casting alloys can be secured from Henning Bros. & Smith, Inc.

46. DESIGN INFORMATION on aluminum and magnesium die castings is contained in literature available from Litemetal Dicast, Inc.

47. JOB STUDY BROCHURE shows analysis of pieces cast in plaster molds by Ohio Precision.

51. ENGINEERING AND PERFORMANCE data on barrel finishing processes are described in a brochure by Abbott Ball Co.

52. PORTABLE BELT GRINDING attachments are described in a folder issude by the Carborundum Co.

53. BARREL PLATING DIE CASTINGS, described and illustrated in a catalog of the Daniels Plating Barrel & Supply Co.

54. TECHNICAL DATA on Dulac Lacquer No. 462 is contained in bulletin No. 110 of Maas & Waldstein Co.

55. HOW TO SPIN-DRY plated and lacquered parts: an illustrated four page folder of the New Holland Machine Co.

56. ZINC PHOSPHATE COATINGS as a paint underbase are described in a technical bulletin of Oakite Products, Inc.

57. SPECIALIZED ALLOY SERVICE for the investment casting industry is the subject of a brochure put out by Cannon-Muskegon.

continued next page

For additional information Circle No. 67 on the Reader Service Card

Spincraft
SKILL WILL DO IT ®
STAINLESS STEEL
Ladles
FOR DIE CASTING

- are lighter in weight
- are easier to pour
- are safer to use
- last MUCH LONGER

For these good reasons—proved conclusively in field service—Spincraft ladles of stainless steel can help increase your production, lower your costs, and build worker good will. It will pay you to investigate this great new ladle that outperforms all others, but asks no premium in price. Write today for an informative bulletin that also illustrates Spincraft's wide range of ladle sizes.

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4131 West State Street
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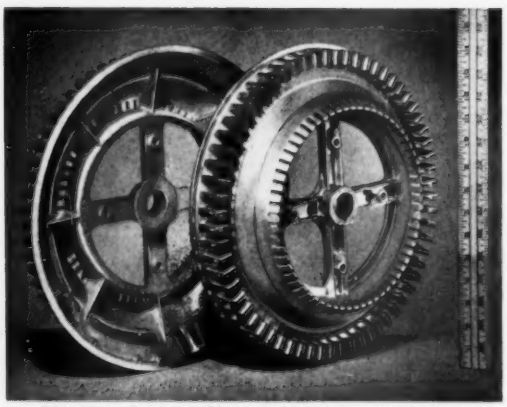

3½ Pound Multi Slotted Aluminum Magazines

FEDERAL built dies and high pressure casting equipment with water hydraulic impact injection assure die castings of GREATER DENSITY and BETTER FINISH!

When better and bigger castings are made FEDERAL'S new and improved machines will be making them. It would please us to help you with your die casting problem.

Aluminum and Zinc Alloys

FEDERAL DIE CASTING CO.
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LICENSED PRODUCER

For additional information Circle No. 60 on the Reader Service Card

REFERENCE MATERIAL — cont.

64. LOWER COST with standard stock bearings. Free literature on these and other powder metal parts is available from National Molded Products, Inc.

67. LADLES FOR DIE CASTERS are described and illustrated in a Spincraft bulletin.

68. A PASSIVATING COLD dip for zinc, bright as well as some colors, is described in The Chemical Corp.'s data sheets.

69. THE FACILITIES and experience in making permanent mold castings are given in an illustrated brochure from Aluminum Permanent Mold Co.

71. ARC FURNACES for investment casting and similar processes are described in a catalog of the Kuhlman Electric Co.

72. MAGNETIC IRON POWDERS are discussed in technical literature offered by Magnetic Powders.

74. A WELL-ILLUSTRATED booklet describing the facilities of Republic Die Casting Co. is now available.

76. WAX MELTING POTS for investment casting are described in the Sta-Warm Electric Co. catalog.

78. EIGHTEEN WAYS to use deburring machines are described in a brochure published by Mead Specialties Co.

80. DIE CASTINGS TO YOUR SPECS, how we do it, is described in a brochure from Racine Die Casting Co.

81. AN ALL STAR CATALOG describing their tools and how to use them has been published by Severance Tool Industries, Inc.

83. BARREL FINISHING, a 61 page book describing the process and equipment, is available from Almco Div.

SHELL MOLD CASTING
continued from page 37

rough sand casting so that the finished plate ready for anodizing shows a manufacturing cost saving of 75 percent.

Dimensionally the foundry is able to hold the plate to ± 0.003 per inch which is well within the requirements. Flatness was maintained so that no surfacing was required.

The as cast surface was sufficiently smooth so that only minor deburring by hand had to be done. The gate and riser were cut off and ground smooth by the foundry leaving only a slight bubrr at the parting line to be removed.

Except for drilling the 15 holes (and lightly counter-boring on the face not shown) there was no machining to be done.

Other real savings besides those reflected in finished piece costs are difficult to express in dollars, but include scrap losses attendant with machining that is now eliminated. Scrap losses due to defective castings are also eliminated as are the manufacture, maintenance, and use of special jigs and fixtures.

As is usual when an attempt is made to reduce or eliminate machining operations, mill-

For additional information Circle No. 77 on the Reader Service Card

Important addition

To SUMMIT-ROBERTS TOOL CO.

... a 2500 ton hobbing press

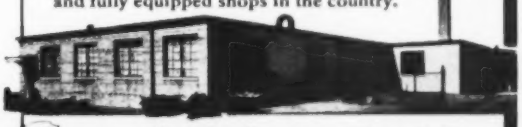
For over 20 years we have hobbed cavities in only the highest quality hobbing steel. Now, by industry demand we offer our services to cold hobb your cavities for

MOLDS for Plastics

Die casting Dies

We can make the hobbs or use yours.

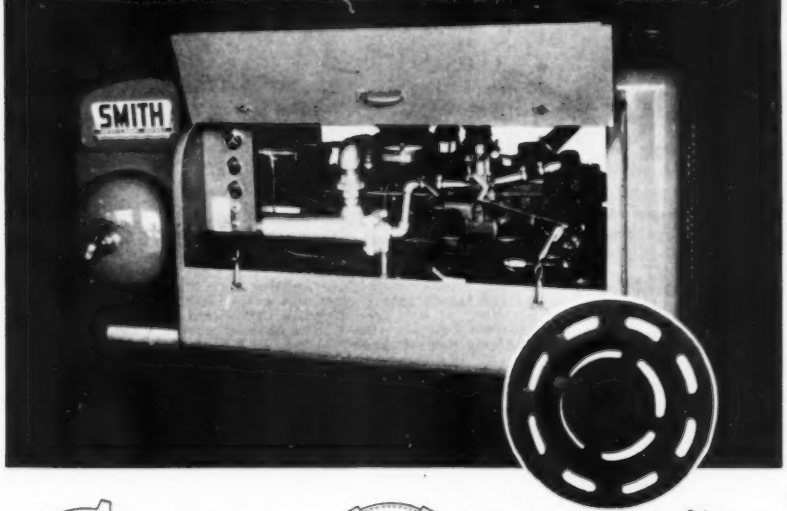
Visit our plant personally and inspect our modern facilities, where you will see one of the most unusual, outstanding and fully equipped shops in the country.

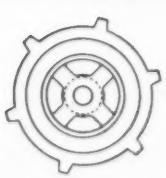


Summit-Roberts Tool Co.

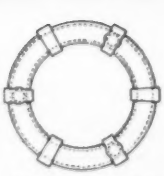
830 NEW YORK AVE. • TOLEDO, OHIO

$2.00 Saving on Compressor Valve Bodies with Ohio Precision Castings





O. P. C. castings for Gordon Smith Compressor, *Left:* Intake Bumper, *Right:* Exhaust Bumper.



Above: Gordon Smith Compressor valve body, an O. P. C. casting.

Gordon Smith & Company, Bowling Green, Ky., air compressor manufacturer, formerly used sand castings for valve bodies and other parts of its Model 105-S Compressor. This required machining of the small ports and slots on a vertical milling machine.

Now, with O. P. C. plaster mold castings in manganese bronze, these slots and ports are cast. Only slight finishing is necessary on these castings — thus saving over $2.00 per valve body, with similar savings on intake bumper and discharge bumper castings.

In like manner, O. P. C. craftsmen, with their vast skill and accumulated experience, are ready to help you save time and money on your production, assembly or experimental work by the use of Ohio Precision Castings.

Write today for your copy of O. P. C. Job Study Brochure on precision casting applications—no obligation!

OHIO PRECISION CASTINGS, INC.

P. O. Box 55, Station "A" • • DAYTON 3, OHIO

Plaster Mold Castings made from

BRASS • BRONZE • ALUMINUM • BERYLLIUM COPPER

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NEXT TO THE AIR ITSELF...

MAGNESIUM and ALUMINUM Die Castings

are Lightest

Ranging from .015 thick automatic pilot parts to thick stressed landing wheels, Die Castings by LITEMETAL are not only light but tough and durable. Some of them are required to be virtually free of surface imperfections and internal porosity.

LITEMETAL is proud of the part it plays in making America strong through air power. Whether the part is just a lid to keep the dust out or is a vital part in a fighter plane, LITEMETAL DICAST engineers are ready to assist in the selection of process, alloy and design.

Die casting with these new light metal alloys offers to manufacturers greater opportunities to lower production costs and the weight of their products. Also, these metals allow more freedom of design and offer greater scope in carrying out the designers' ideas. In addition, these die castings save many man-hours of finishing time.

Die Castings of magnesium or aluminum may offer you solutions to many of your cost and production problems.

LITEMETAL DICAST, INC. is an organization of specialists—men thoroughly experienced in the casting and machining of magnesium and aluminum alloys—the new metals of structural design.

Write today for literature and design information.

Quick action on inquiries.

LITEMETAL DICAST Inc.

A DIVISION OF HAYES INDUSTRIES

1925 WILDWOOD AVE. · JACKSON, MICHIGAN

PLANT AND EXECUTIVE OFFICES

For additional information Circle No. 46 on the Reader Service Card

ing is generally given the most careful scrutiny since it is one of the most expensive shop operations to perform. As can be seen, a majority of the finish machining operations on this plug fastener plate are of that class which can account for the very large saving realized by conversion to shell molded castings.

INDEXING FROM CORED HOLES

continued from page 44

conditions the greater length of time required to amortize the dies is justified.

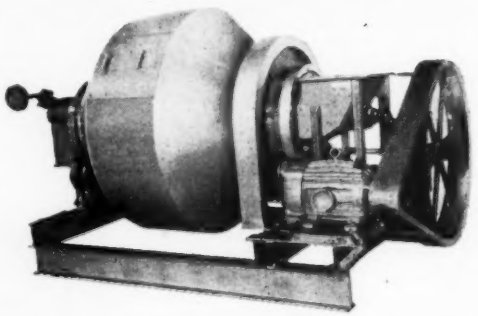
While two porous bronze bushings are used on the wheel bearings, the drive shaft bearings are the zinc die casting. The use of the die casting alloy as a bearing material has proven quite satisfactory in this application due, possibly, to the intermittant service of the unit.

The cavity shown at "d" in Figure 1 is a housing for the switch and a junction box. By designing this box into the casting the need of a separate switch box has been eliminated.

Quick — Thorough — Uniform

POWDER METAL BLENDING

with this Rotary Batch Mixer



Its mixing principle is one of tumbling . . . turning . . . folding . . . cutting . . . dividing . . . stirring! With this Rotary Batch Mixer, you can get an extremely thorough blending of dry free flowing ingredients in the shortest possible time — with a minimum of power . Available in small or large capacity.

OTHER BAILEY EQUIPMENT

BAILEY RIBBON MIXERS are idealy suited for intensive blending of all fine materials. Rugged, heavy duty all welded construction of any metal or alloy you specify.

ROTA SIFTER for screening or grading powdered materials. One, two or three screen construction.

BAILEY VERTICAL SCREW ELEVATORS in almost any height. Handles any dry free flowing material.

We also have crushers, pulverizing and conveying equipment.

Our satisfied customers include such companies as National Lead, American Cyanimid, Borden, Armstrong Rubber and many others. Write us your requirements.

R. N. BAILEY & CO.

11 West 42nd St., New York 36, N. Y.

For additional information Circle No. 70 on the Reader Service Card

The outer cover or shroud is an acetate type of plastic that has adequate strength for the service requirements but has poor dimensional stability. It is, therefore, necessary to

2. THE CLEAN LINES and smooth, safe operation of this knife sharpener are made possible through the use of a die cast frame which acts as a supporting member for all parts.

provide support for the housing. This support is incorporated as a portion of the main frame casting.

For additional information Circle No. 75 on the Reader Service Card

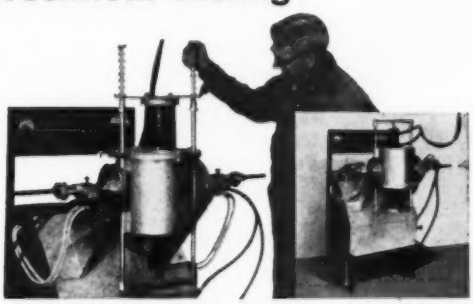
CAUGHT in the WHIRLPOOL
of misinformation

Fantastic Claims May Put You In This Mess!

We offer you an honest, reliable solution to your INVESTMENT CASTING PROBLEMS.

SCOTT CASTING & MFG. CORP.
BERWYN, PA. ESTABLISHED 1945

Direct-casting Electric Furnace for better, faster precision investment casting



Melting position *Casting position*

The new, type IC, 12 kw., 10-lb. Detroit Electric Furnace melts and pours heats of chrome-nickel, Stellite or superalloy steels in 9-12 minutes. Casting is done by inverting the furnace, pouring directly into the investment mold which is held in place by air pressure. Melting by fast, controlled, indirect arc minimizes carbon pickup and alloy variation. Simple, efficient operation is ideal for high production of precision castings.

Write for complete information.

DETROIT ELECTRIC FURNACE DIVISION
KUHLMAN ELECTRIC COMPANY
1070 26th St. • BAY CITY, MICHIGAN

Foreign Representatives: in BRAZIL—Equipamentos Industrias, "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castelvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Cia Proveedora de Industrias, Atenas 32-13, Apartado 27A3, Mexico 6, D. F., Mexico; EUROPE, ENGLAND: Birlec, Ltd., Birmingham.

For additional information Circle No. 71 on the Reader Service Card

PEERLESS

STANDARDIZED PINIONS and RACKS

FOR

DIE CASTING MOLDS
PERMANENT MOLDS
PLASTIC MOLDS

Standard sizes of Peerless "Flame Hardened" Ejector Racks and Pinions are available for prompt shipment. Special sizes may be produced to your specifications.

We welcome your inquiries.

Peerless Gear & Machine Co.
320 N. WESTWOOD AVENUE
P.O. Box 317, Station "C"
TOLEDO 7, OHIO
Established 1921

For additional information Circle No. 73 on the Reader Service Card

Finishing of the casting is rapid and simple. Bushing holes are reamed to remove the casting draft of 0.003 and the two bronze bushings pressed in. No tapping is required since self tapping screws are used in the assembly. Thus, except for the one reaming operation, completion of the sharpener unit is simply an assembly operation which can be done quickly and easily.

LONGER SERVICE LIFE
continued from page 27

metal part instead of a wrought metal part. Wear resistance is of prime importance on this part. The porous bronze cam impregnated with oil has considerably greater life than either hardened steel or wrought bronze: the two predecessor materials.

Finally, the powdered iron part shown in Figure 1c is the so-called up-and-down cam for the 8 mm projector. Again, wear resistance is the principal reason for change from wrought metal to an iron sintering.

For both of the cams shown in Figures 1b and 1c, dimensional accuracy is high. As furnished by the vendors, cam throw is held to ± 0.0015 while the dimension across the face at any point must be held to 0.0015 TIR. Thickness is not critical and normal powder metallurgical tolerances of about ± 0.005 are adequate. In both of these cams, there has been an appreciable saving due to the release of machines for other work. Had powdered metal parts not been used, a rather high capital investment in machine tools would have been necessary.

The gear shown in Figure 1d is in iron powder. Despite the fact that a helical gear of this type can be molded complete from iron powder, it is desirable for this gear to use a helix angle somewhat greater than can be made by powder metallurgical processes. For this reason gear blanks are prepared from iron powder that are complete and to size so that only a gang tooth cutting operation is necessary to finish them. Such a gear, meshing with a worm, has longer life and quieter operation than the duronze gears previously used. In addition to improved operation, there is a cost reduction on this part of about 10 percent.

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MAGNETIC IRON POWDERS
for ELECTRONIC and INDUSTRIAL APPLICATIONS

OUR *Laboratory* FACILITIES
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WRITE for this free technical bulletin TODAY!

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For additional information Circle No. 72 on the Reader Service Card

For the RIGHT wax melter
for your expendable patterns
INVESTIGATE STA-WARM

Sta-Warm offers you wax melting equipment in a wide range of capacities from 5 to 100 gal. You may be assured of just the right temperature with Sta-Warm equipment to produce clean, sharp investment castings at the end of the line.

You can make good use of Sta-Warm's long experience in melting, handling and dispensing wax.

Write today for information, outlining your requirements.

- TOP: "WV" wax pot, built in a wide variety of sizes.
- BOTTOM: "WV" wax tank, with close tolerance temperature control.

Sta-Warm ELECTRIC CO.
525 N CHESTNUT ST. • RAVENNA, OHIO

For additional information Circle No. 76 on the Reader Service Card

REPUBLIC STEEL TO PRODUCE IRON POWDER IN TOLEDO

An announcement from the Republic Steel Corp. of their entry into the iron powder field climaxes almost five years of intensive research and development work.

The direct reduction of ore to metal, without a blast furnace, has been one of the major interests of this company for many years according to Earl Richards, vice president in charge of production and planning. The iron powder plant to be built in Toledo, Ohio on land adjacent to the new Sun Oil Co. plant is the first step in this long range development.

Earl Richards

The initial installation will have a capacity of approximately 10,000 tons of iron powder per year of a grade specifically designed for use in powder metallurgy and flame cutting and scarfing — the two largest uses of iron powder.

Details of the process have not yet been released, but the need for large quantities of hydrogen, a by-product of the Sun Oil plant, indicates that a part of the process, at least, will be by hydrogen reduction.

The new plant will operate continuously and will be highly mechanized. When operating at full capacity about 100 persons will be employed.

HEADS MERCAST CORP.

Election of S. J. Sindeband as president of the Mercast Corporation, New York, N. Y., has been announced by the board of directors.

Mr. Sindeband, who was advanced from the position of executive vice president, is also president of Alloy Precision Castings Company, Cleveland, Ohio. This latter firm is a Mercast licensee.

Light and Tough
FOR HEAVY DUTY SERVICE
ALUMINUM MOTOR HOUSING FOR TRUCK AXLES
Here is a typical Accurate die casting which is subjected to strain and rough usage under adverse operating conditions. Minimum weight and maximum strength are combined to assure long life and top performance in this motor housing for Eaton's Famous 2-speed axle Electric Shift. You too may be able to save time and money and get the production you need when you want it with an "Accurate" die casting.
Bring your design and production problems to our Engineers. Write or wire today for prompt service.
ALUMINUM • ZINC • MAGNESIUM DIE CASTINGS
ACCURATE DIE CASTING CO.
3089 E. 80TH STREET • CLEVELAND 4, OHIO

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For Your Ferrous Casting Needs Get These...

4 Freedoms

Freedom from...
1 Porosity
2 High Cost Material
3 Expensive Machining
4 Metallurgical Variation
with
PERMANENT MOLD Gray Iron Castings

Permanent Mold Gray Iron Castings by DOSTAL offer many advantages. Their structure is uniform and surface scale is eliminated. These 2 factors permit higher speed machining with faster feeds. The dimensional accuracy and uniformity of DOSTAL Permanent Mold Castings reduces machining operations to a minimum. Permanent molded castings are uniform in hardness and their structure is dense and porous-free.

Write Us Now - find out how you can cut the costs of your products through the use of Permanent Mold Gray Iron Castings

DOSTAL
FOUNDRY and MACHINE COMPANY
2504 Williams Drive
Box 180 Pontiac, Mich.

Circle No. 59 on the Reader Service Card

OPPORTUNITIES

MANUFACTURER'S REPRESENTATIVE — wanted for Wisconsin to handle ferrous and non-ferrous investment casting line. Write Box 8153, Precision Metal Molding.

WANTED: Reed Prentice 1½ die casting machine, Late model either cold or hot chamber. State price and condition. Write Box 8253 Precision Metal Molding Magazine.

NEW INVESTMENT CASTING FACILITY INSTALLED BY NAVAL ORDNANCE

The Naval Ordnance Test Station at China Lake, California, has installed a new investment casting laboratory for experimental work on complex ordnance parts.

The new laboratory will add information to the open literature, investigate additional uses for the process, and work toward possible improvements.

The investment casting process which emerged as an industrial process during World War II after many centuries primarily used for creative and dental applications, is now widely used. One of the most generally recognized uses has been the production of supercharger buckets from difficult-to-machine super alloys.

Several Army Arsenals have previously established investment casting departments to carry out similar programs in ferrous and non-ferrous metals. Army Ordnance has approved many investment cast components for light arms, rifles and similar equipment.

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SEVERANCE REGRINDING SERVICE
CONSERVES STRATEGIC MATERIALS
ASSURES DEPENDABLE DELIVERIES
SAVES YOUR MANHOURS
PAYS DOLLAR WISE
HAVE YOUR DULL CUTTERS REGROUND REGULARLY

THE Severance LINE INCLUDES
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SPECIAL CUTTERS
CARBIDE HAND FILES
TUNGSTEN CARBIDE CUTTERS
CHATTER LESS COUNTER SINKS

Severance TOOL INDUSTRIES INC.
732 Iowa Ave., Saginaw, Michigan
If you don't have a SEVERANCE "ALL STAR" Catalog, ask for one today!
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Produce
STRONGER COMPACTS
With Fernlock Copper Powder

The highly irregular shape of each particle of Fernlock copper powder results in compacts having superior green strength.

Interlocking action of these dendritic powder particles also makes Fernlock an outstanding powder for the production of friction materials and carbon brushes.

Samples for testing will be sent on request

MMP
MALONE METAL POWDERS, INC.
220 WEST 42nd ST.
NEW YORK 36, N. Y.

Circle No. 79 on the Reader Service Card

DIAMOND WHEELS
continued from page 53

controlled truing device is used. Two wheels are "trued" at the same time. They are pancaked together in a Delta Toolmaker held on a magnetic chuck. While the diamond wheels rotate, the rotating grinding wheel is passed back and forth across their face.

As long as 30 minutes of grinding is done, with approximately 1/32 of the diamond

4. BEFORE AND AFTER the wheels are trued and dressed. The wheels on the left, because of their condition, are of very little use any more. Their cutting action is increased by 80% after grinding and brushing.

wheel taken off, depending on the amount of "truing" necessary, Figure 2.

When the surface of both diamond wheels is uniform and there is no visible parting line between the two wheels, the operator estimates that the wheels are squared up.

"Dressing" the wheels is done by an 8 inch Osborn wire brush. Both the brush and the diamond wheels rotate at 3600 revolutions per minute. The object here is to remove some of the brass matrix, leaving the diamonds sticking up for better cutting action.

DEPENDABLE
BETTER METHODS
SUPER CAST
DIE CASTINGS
BETTER DIE CASTINGS
SINCE 1919

The meaning of a signature!

Through a quarter of a century of knowing how, the Super Cast reputation for Better Methods—Better Die Castings, has been recognized.

Sound engineering, metallurgical knowledge and skilled techniques have achieved and maintained a standard of superior quality.

Super Cast has kept faith, always deserving the mark it bears. Super Cast means die castings for those who want the best.

A sound, time-tested institution and a sound time-tested product have won confidence and widespread endorsement.

DEPENDABLE
BETTER METHODS
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THE SUPERIOR DIE CASTING COMPANY
1001 London Road · CLEVELAND 10, OHIO

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For additional information Circle No. 58 on the Reader Service Card

A COMPLETE DIE CASTING SERVICE
. . . FROM DESIGN TO FINISHED PRODUCT.

No matter what your die casting requirements may be, Central has the facilities, the equipment, the experience and trained personnel to produce castings to meet your rigid specifications. Take advantage of Central's complete facilities and be assured of prompt economical service on the best castings made.

- Complete engineering and design service
- Die and tool making
- Most modern production equipment
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May we help you with your production requirements.

Write today for prompt and practical assistance

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Exact samples in a hurry
with MASTERMET alloys

When you need to furnish sample investment castings in specified alloys it's time to call Cannon-Muskegon for MasterMet certified alloys. Our small 100-pound test crucible enables us to produce small melts for your samples. Then our larger production furnaces assure you identical, uniformly castable metal for the production run. Another service is help in calibrating the loss characteristics of your remelting furnace, so you can order alloys specifically tailored for loss expectancy. MASTERMET is available in SHOT or INGOT form for best melting in YOUR equipment.

Write Cannon-Muskegon for a brochure covering our facilities or for an actual sample of our product.

CANNON-MUSKEGON
MUSKEGON, MICHIGAN

For additional information Circle No. 57 on the Reader Service Card

FIRST TITANIUM LABORATORY

The country's first industrial laboratory to be devoted exclusively to research and development on titanium has been formally opened at Niles, Ohio by Mallory-Sharon Titanium Corporation and dedicated to the two business leaders responsible for the formation of the company: Henry A. Roemer, chairman of the board of Sharon Steel Corporation, and Philip R. Mallory, chairman of the board of P. R. Mallory & Co., Inc.

The new laboratory will be devoted to basic research, development of titanium and titanium alloys, and production testing.

COMBINE & ELIMINATE

continued from page 29

The extruded housing was finished with satin chrome plate, and the stampings which formed the window openings were painted black. Now, the die castings are suitable for a durable, low cost baked wrinkle enamel, and only the two small window bezels are chrome plated.

From a production point of view, the die casting is a striking contrast with the variety of miscellaneous pieces previously used.

From a four-cavity die, an entire unit is produced in each shot. This helps in inventory maintenance, uniformity, and delivery. It supplants the large number of tools, dies, fixtures and gauges that were a requisite of the old type of design.

Altogether, the change-over has brought the photographer many benefits, some of which are apparent to him in improved performance, longer serviceability and better appearance. Others, such as the offsetting of steadily increasing labor costs by eliminating many of the manual operations, are only indirectly apparent in low cost.

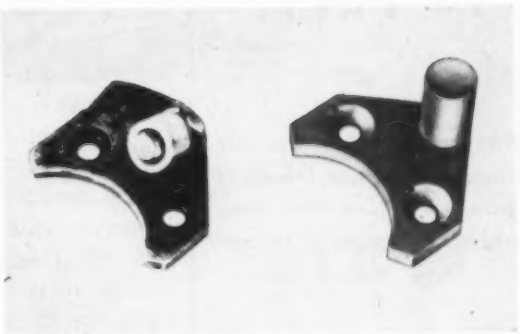
SIMPLIFIED SOLUTIONS

for production problems

DAILY STOPPAGES of a conveyor system have been eliminated by replacing the fabricated part shown at the left by an investment casting, right. Twisting and breakage of the fabricated part resulted in frequent interruption of the conveyor on which it is used.

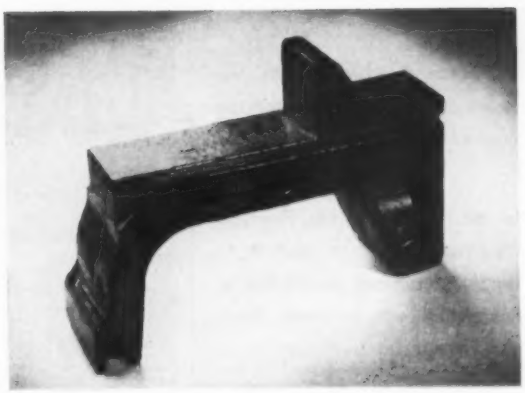
Now, Westinghouse Lamp production has been increased because a more dependable component has replaced the fabricated unit that was built of a machined stamping, two screw machine parts and a hardened steel bushing. The new component is a one-piece investment casting produced in air hardening tool steel by Engineered Precision Casting Co. The casting is used without further machining or heat treatment. Its hardness is Rockwell C 53 to 55.

The casting is so successful that Westinghouse engineers are now trying to develop rollers for the conveying system to match the life of these castings.



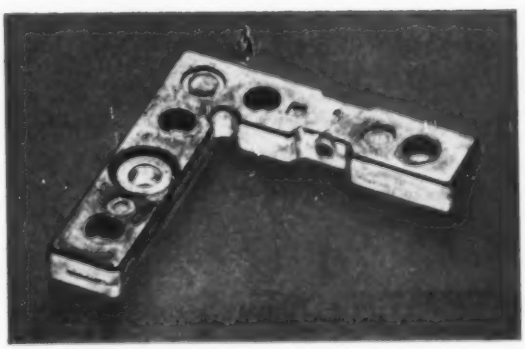
METAL LIGHTENERS and cored holes on this brass permanent mold casting represent considerable saving in metal and secondary operations when compared with the brass extrusion it has replaced. It is used on electric control equipment. This casting, weighing 8.03 pounds, is produced in leaded brass by Pressco Casting & Mfg. Co.

Among the expensive machining operations that the extrusion required was a milling operation to form the step at the top of the casting, plus several drilling operations. By means of a permanent mold casting excessive wall thickness has been reduced without impairing the strength of the piece.



MEANS OF FASTENING TWO EXTRUSIONS is the small angular zinc die casting shown at the right. The extruded frame pieces for aluminum casement windows are slipped over the ends of the die casting and crimped into place. The zinc die casting is strong enough to make a solid joint.

As produced by Dollin Corp., the corner piece is ready for assembly with holes cored. If punched or formed, secondary operations would have been called for to produce the holes. While this piece is a relatively simple and inexpensive die casting, its cost would be quite excessive by any other process of forming.



INVESTMENT CASTINGS FINISHED TO PRINT

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HIGH FREQUENCY CORES
continued from page 32

At this point it may be of interest to note that tooling of powdered iron cores is originated in a manner somewhat unusual for a job-order industry. Tooling for the common, simple cylindrical shapes of insert cores and threaded cores is never charged to the customer, but is considered a part of manufacturing cost. Iron core material formulations are highly abrasive and tool life is relatively short. For this reason, most manufacturers make routine tools on a production basis, for stock, with die cavities, upper punches, ejectors and core rods as interchangeable parts. Because of the variety of customers' requirements, certain nominal sizes

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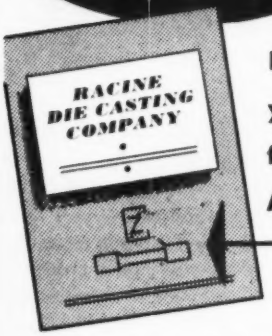

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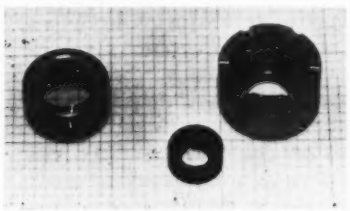
require stocks of tools to cover a wide decimal range. The largest of these groups are: ¼" nominal, requiring tools from .233 to .255; 5/16" nominal, requiring .300 to .315; and ⅜" nominal, requiring .360 to .375.

This wide range of requirements appears to indicate possibilities for the maximum use of tools through reclamation. While this is the case to a limited extent, savings through tool re-use do not nearly compensate for the additional press changes required by unnecessary minor variations in diameter tolerances.

The core manufacturers, through the Metal Powder Association, have established a list of Preferred Iron Core Dimensional Specifications (MPA Standard 11-53 T). It is



TOROIDAL AND CUP CORES — generally these cores require little if any secondary machining after pressing and sintering.

anticipated that in years to come, core designers will tend to use the preferred dimensions where practicable, and eliminate this unnecessary press downtime. Under present conditions however, several electrically identical cores may require individual setups. The differences are solely diameter variations inconsequential to the end-use, and invisible to the eye.

A visual examination of the cores illustrated would lead an interested observer, or one accustomed to pressing complicated shapes, to believe that core pressing should be problem-free. Nevertheless, one complicating factor in the

continued next page

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pressing requires a great deal of attention. That attention-getter is the fact that permeability, other things being equal, is a function of core density which, in turn, is controlled by die-fill and pressure.

Any discussion of density in relation to core permeability can be misleading since the production line method of measuring both these qualities is subject to several inaccuracies. Almost all core measurements are comparison tests in which the unknown core is checked electrically against a known standard core of nominal value. Permeability is measured as either "high" or "low", in comparison to the standard.

Cores are tested in coils which are similar to the production coils in which production cores will be used. Coils differ widely in their sensitivity to permeability variations of cores being tested. A core which reads 1 percent higher permeability than the standard core in one test coil, may read as much as 3 percent high in another test coil.

The type of winding, wire size, winding length and position on the coil form all tend to vary the sensitivity of coils used for testing. References to "permeability" mean effective core permeability when measured in the particular test coil intended for that core, expressed as a comparison with a previously established standard core.

Variations in the permeability of the raw powder, variations in the non-ferrous components of the mix, and variations in the mixing processes all combine to yield mixes of varying permeabilities. These variations must be compensated for by varying the density of the compact. At the same time, over-pressing must be avoided. In addition to extra die wear, excessive pressures can cause a breakdown of the insulation, with its consequent increase of core losses, or swelling and cracking during the curing cycle.

Under-pressing can cause physical weakness in the finished piece. Add to this situation the fact that most presses are mechanically actuated, and we have a process requiring talent as well as engineering skill. At this stage in the manufacture of cores, control is achieved by pre-testing each mix to determine its permeability under fixed conditions or by a test cure of the first few pieces pressed. Fortunately, most core materials are soft enough to withstand reasonable latitude in molding pressure. When variations in material permeability cannot be compensated for by pressure and fill variations, it is sometimes possible to blend in

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a quantity of higher or lower permeability material of the same sieve distribution and loss characteristics.

Over 90 percent of powdered iron high frequency cores are pressed with the direction of pressure parallel to the long axis of the piece. This method results in varying density throughout the length of the compact. As might be expected, the use of top pressure alone results in the area of lowest density at the bottom of the core. Similarly, the use of equalized top and bottom pressures results in a low-density area in the center. The difference in permeability between the high-density and low-density areas becomes more pronounced as the ratio of core length to core diameter increases.

In the case of cores used for permeability tuning, as in most automobile radios, core permeability must be held to very close tolerances between lengthwise segments in order to insure uniformity of the (non-linear) frequency changes as the cores are inserted further into the coils. A low density spot in the center of these cores, (usually .200 diameter x 1.500 long) would prevent satisfactory tuning.

To insure uniformity with respect to longitudinal segments of a given core, permeability tuning cores are molded on the side, with feather-edge punches. Thus the high density areas and low density areas are evenly distributed along the longitudinal axis of the core. Any molding flash, or oblate cross-sections due to flat surfaces on the sides in contact with the die walls, can be eliminated by centerless grinding if necessary.

Pressed pieces in the uncured state are brittle, but most shapes can be permitted to tumble down the discharge chute of the press table where they are collected in pans. Pan loading varies somewhat, but averages about 8-10 lbs for best results in curing. The plastic binder is cured in low-temperature ovens (300-350F) with a time-temperature cycle depending on the specifications of the resin and the size of the pieces being cured.

When batch-type ovens are used, the volume of the entire load must be considered. Fortunately, most binders are not harmed by a little extra heat. A heavy oven-load or a load of large pieces will require a different curing cycle than a lighter load. Temperatures in different locations inside the oven should be within ± 5F for uniformly complete curing.

After the cured cores have cooled they are ready for secondary operations. About three quarters of all cores require such operations as centerless grinding, centerless thread

continued next page

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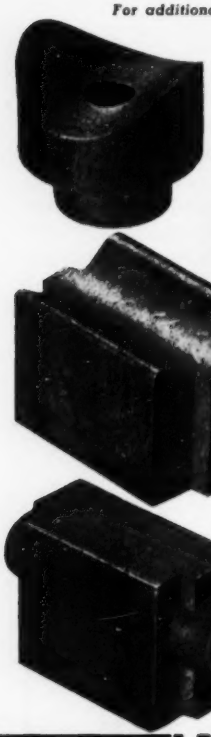

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grinding, color coding or rust-proofing. Of all these, the most important is the centerless thread grinding of threaded cores.

Threads are ground on hopper-fed, through-feed type centerless grinders to a variety of diameters, pitches and thread configurations. The most common diameters are .181, .238 and .249, with pitches of 20, 28, and 32 threads per inch. Thread forms are crushed into the face of the grinding wheels, by hardened steel crusher rolls, as radial rings of the required profile.

Helical angles are obtained by the angle of the steel work-rest, on which the pieces ride through the grinder, and by the angle of the work-wheel which holds the pieces against the rest and the grinding wheel.

Although powdered iron cores can be machined only with difficulty and a high rate of tool wear, they can be ground easily. The usually required diameter tolerances of ± .001 are readily maintained. Permeability tolerances, however, are more troublesome.

The grinding of a thread on the outside diameter of a cylindrical slug reduces the mass by 6 to 20 percent and is accompanied by a drop in effective permeability which, in actual practice, cannot be exactly pre-determined. For example, a ¼ - 20 thread will remove more material when the grinding wheel has been freshly dressed (thread depth at maximum, crest and bottom sharply delineated), than when the wheel is almost ready for re-crushing (thread depth near minimum, crest and bottom slightly rounded).

This variation, in addition to the usual permeability variations of mix, fill, etc can be compensated for, to some extent, by varying the outside diameter of the core within the

± .001 tolerance previously mentioned. However, this permissable diameter variation is sufficient to cover all variables only when permeability tolerances are opened to + 5 percent — 2 percent rather than ± 2 percent, the tolerance acceptable for unthreaded cores. Those designs which require ± 2 percent are controlled by a test grind of a few pieces. This test determines the exact drop in permeability due to grinding. From the results of this test the as-pressed permeability limits are set.

Secondary operations other than grinding present few problems. Rust proofing specification determine the method and material; color coding is done by dipping or hand-painting; other operations are of routine interest only. Throughout all secondary operations each pan of cores is usually kept intact, with its own identifying tag. This tag,

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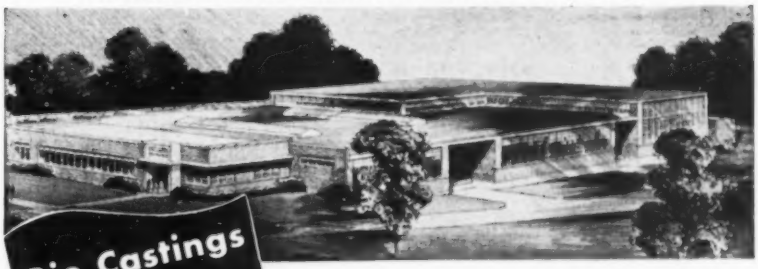

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which shows date and time produced as well as other data, accompanies the pan of cores through final inspection.

Final inspection is a sampling process, based on accepted methods of statistical quality-control, in which 1 percent or 2 percent of each pan-load is tested for mechanical and electrical qualities. If a single reject is discovered in this sampling, a second sampling is made. If one reject appears in the second sample, the pan is set aside for either 100 percent checking, or for scrapping.

The decision to inspect 100 percent or to scrap is made on the basis of estimated proportion of salvageable pieces, and their value, versus the cost of inspection. Those plants having strong in-process quality control systems are not required to make this type of decision often since tendencies toward rejectable defects are usually corrected before they have gone very far.

One example of in-process quality control, which may or may not be typical, is the system in use at Pyroferric Company, Inc. The quality control section is entirely independent of production personnel and is responsible only to the chief engineer. Incoming material is checked on arrival, mechanically in the case of mix components. Occasional in-process spot-checks are made on powder preparation processes and frequent tests are made of finished batches.

A continuous press control record is kept. This record indicates the results of half-hourly sampling tests of the output of each press. Dimensions and electrical readings are charted. Any trend toward dimensional or electrical limits is thus spotted immediately by the inspector and the necessary adjustment is made before the limits have been exceeded.

As can be seen, high quality levels with close electrical and mechanical requirements call for painstaking care at every step in the manufacture of high-frequency powdered iron cores. Constantly improved manufacturing methods and controls have enabled this almost unknown segment of the powder metallurgy industry to grow to its present point, with every promise for further expansion.

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CONSULTANT ON LIGHT METALS

Robert J. Anderson has announced the opening of his offices as consulting metallurgist on aluminum and magnesium. He is located at 924 W. Mulberry Ave., San Antonio 1, Texas.

INDUSTRY NEWS

MILNE TO BUILD TOOL STEEL WAREHOUSE

A. Milne & Co., nationwide distributors of solid and hollow tool steels have broken ground for a new building for their Chicago sales office and warehouse. The site is located at 2080 N. Hawthorne Ave. in the Clearing Industrial District, Melrose Park section of Chicago.

The building will be of modern architectural design with face brick, steel sash construction with approximately 12,000 square feet of warehouse floor area. The building has been designed to permit the simultaneous loading of two full trailer trucks entirely within doors. Occupancy of the new building around October first of this year is expected. Milne's present Chicago office and warehouse stock of tool steels are located at 17 N. May Street, Chicago.

A. E. S. AWARDS PRESENTED AT CONVENTION

The following awards were made June 15, 1953 by the American Electroplaters' Society in convention in Philadelphia.

The Carl E. Heussner award, the top award of the Society, to William C. Geissman and Robert H. Carlson of the National Lock Company, Rockford Illinois, for their paper "Current Distribution in Barrel Plating — A Statistical Study".

The A. E. S. Silver Medal to R. F. Ledford of Industrial Filter & Pump Mfg. Co., Chicago, Illinois and E. A. Dominik of Lake Shore Electrotype Co., Chicago, Illinois, for their paper "Comparative Wear Characteristics of Some Electrodeposited Metals".

The A. E. S. Bronze Medal to Stanley L. Eisler of Rock Island Arsenal, Rock Island, Illinois, for his paper "Radioactive Isotope Dilution Method for Determining Sulfate Concentration in Chromium Plating Baths". This is a new A. E. S. medal sponsored by the Grand Rapids Branch.

The Chromium Plating award to Lloyd Gilbert, Rock Island Arsenal, Rock Island, Illinois, W. S. Morrison and

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Floyd H. Kahler of Illinois Water Treatment Co., Rockford, Illinois, for their paper "Use of Ion Exchange Resins in Purification of Chromic Acid Solutions".

The Precious Metal Plating award to Harold J. Wiesner, Bendix Aviation Corporation, South Bend, Indiana, for his paper "Some Experiences in Heavy Rhodium Plating".

A AND P TO MAKE TITANIUM-ALUMINUM

Alloys and Products, Inc., 1101 Oak Point Avenue, New York 59, N. Y., has embarked on a program of the volume production of titanium-aluminum alloys, it has been announced by Andrew E. St. John, president.

The principal product will be the 5 percent titanium alloy which is used by producers of primary aluminum and by aluminum foundries. Titanium-aluminum is a master alloy used as an additive to aluminum alloys to promote reduced grain size and improve mechanical properties of the finished product.

Although Titanium-Aluminum alloys were manufactured in a small way previously, the present program will put Alloys and Products in the field of large scale production. The new development is based on an improved process in the manufacture of this product developed by the company. A melting capacity of 2,500,000 pounds per year has been installed.

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STANLEY P. SAX ELECTED VICE PRESIDENT OF AMERICAN BUFF COMPANY

The American Buff Company, Chicago, has announced the election of Stanley P. Sax

STANLEY P. SAX

as vice-president of the company. Mr. Sax is head of sales in the Midwest area, with headquarters in Detroit.

He has been affiliated with American Buff Company since October, 1948. A Phi Beta Kappa graduate from the University of Wisconsin, he spent 3 years in the Pacific Theatre of War, and is now a Captain in the U. S. Infantry Active Reserves.

INVESTMENT CASTING GROUP ELECTS

NOW firmly under way as a functioning organization, the Investment Casting Institute held its first annual meeting in New York June 26 and elected officers.

K. M. Bartlett of Thompson Products, Inc., Cleveland, who had served as temporary chairman during the organizational sessions, was elected first president of the Institute.

V. S. Lazzara of Casting Engineers, Inc., of Chicago, was elected to serve as vice president of the group which met for the first time in January of this year to study the possibilities of organizing.

Board of directors elected include: one year term, W. A. Dubovick of Engineered Precision Casting Co., Matawan, N. J.; R. S. Banister, Midwest Foundry, Coldwater, Mich.; R. D. Gumbert, Alloy Precision Castings Co., Cleveland, Ohio.

For two year terms: T. Operhall, Misco Precision Casting Co., Whitehall, Mich.; L. E. Brooks, Jelrus Precision Casting Corp., Brooklyn, N. Y., and K. J. Yonker, Howard Foundry Co., Chicago, Ill.

Besides naming its officers for the coming term, the group put through one change in its constitution affecting the status of members of the Institute who are not producers of investment castings.

The constitutional change defines "affiliate members" as those who are in a position to contribute technical services to the industry. Affiliate members may not vote or hold office but may serve on committees.

Initiative for calling together the first meeting last January to discuss the formation of an organization of investment casters, was taken by Precision Metal Molding magazine at the request of several leading producers of investment castings.

Wider dissemination of information about investment castings, consideration of industry standards and similar steps to broaden the industrial uses of investment casting were among topics discussed. Awareness of these needs gave impetus to the drive toward organization, and the group met almost monthly.

A committee appointed by Mr. Bartlett to investigate the type of organization that would best serve the purposes expressed by members attending the meetings drew up a tentative constitution. This was approved in May.

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LEAD DIE CASTING
continued from page 43

sented to avoid errors in setting and to hold parts.

In addition the machining of slot, e, (by milling) was ruled out as uneconomical because of the close limits specified and the need to form the end of this with sharp corners.

In view of the large number of components required, even though such machining limitations could be successfully surmounted, it was apparent that a very high cost would be involved in jigs, fixtures, special forming tools, gauging equipment and inspection needs.

Can it be formed by stamping?

The manufacturer of the metering device, next considered the possibilities of forming such sealing plugs by the pressing method, using a stamped out disc as a blank in the press-tools.

This again proved unfruitful because it was found such parts could only be pressed to final shape over several different operations, for which a number of intricate press-tools were needed.

The degree of accuracy obtained by such means on the critical portions of the plugs was wholly outside the permissible limits laid down, and it was clear that even though parts might be pressed in this manner, a considerable amount of machining would be entailed to bring them to the desired accuracy.

Can it be built-up or sand cast?

The user also considered adopting a built-up construction comprising two main portions, a hollow conical sleeve which could be machined rather more easily and into which could be mounted the cylindrical stalk, c, made separately.

This method had to be abandoned after a few trials owing to the impossibility of ensuring that the stalk would be securely mounted in place and set central with the conical hole, b. There had to be not the slightest risk of such a stalk working loose during operation in the metering device.

Sand castings, in a suitable lead alloy, were also tried in an endeavour to overcome the many difficulties, but with no success. While it was a comparatively simple casting job to produce conical blanks of this kind, extensive machining was required to form hole, b, stalk c and slot e, and of course all surfaces of the component had to be lightly machined to bring to final sizes. Thus the same objections arose for solution as with machining from extruded rod.

From whichever angle of production by orthodox methods this problem was approached, no economical or feasible solution could be obtained.

Finally, a die caster was appealed to in the hope he could suggest a reasonable way out of this apparently insoluble problem. In putting this project before the die caster it should be remarked that no substantial departure was permissible in respect of the shape, features and certain dimensional tolerances.

The problem was easily solved by the die caster as shown by Figure 1, the production being relatively simple and inexpensive despite the unusual features.

A comparatively simple die casting die was designed to produce the sealing plug in the required antimonial-lead alloy. A brief description of the design, construction, and opera-

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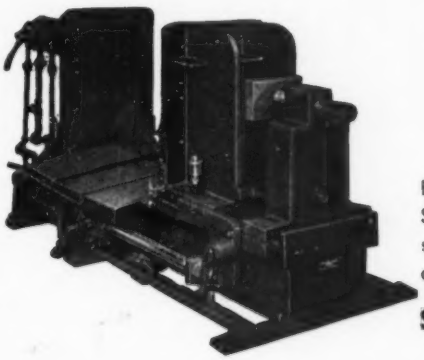

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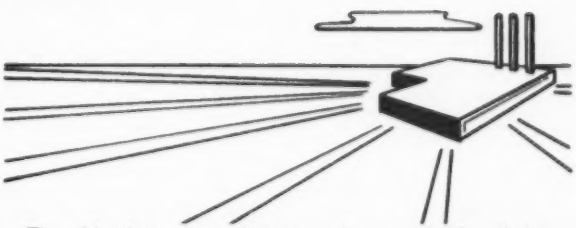

The old adage about the man who can build a better mousetrap has been overworked, but if you were to look at a list of Republic's customers, you would see that a company that produces better die castings draws its customers from all over the country. Fortunately, we are centrally located, convenient to the major manufacturing areas. We have modern manufacturing facilities and highly skilled personnel. But don't take our word for it. We have a brochure designed to show what we can do for you. Drop us a card or letter and we'll be happy to send our illustrated brochure free.

Die castings in zinc and aluminum alloys

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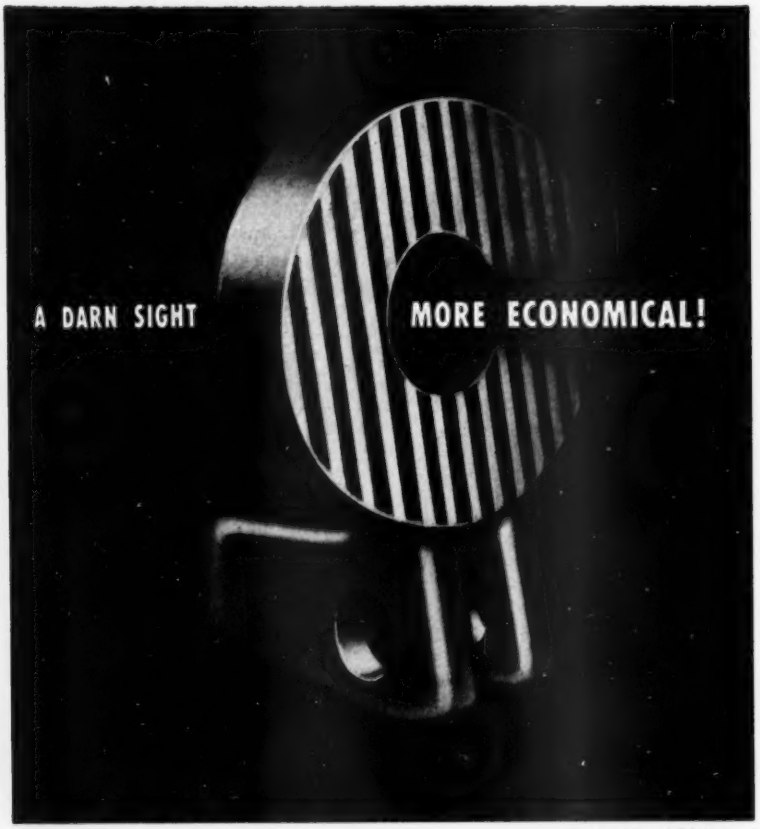

Part enlarged 14 times

An investment casting made of BERYLCO BERYLLIUM COPPER

One of the smallest castings ever produced, this rifle peep sight of Berylco beryllium copper was formerly machined from extruded steel stock. Size made machining difficult, and it was impossible to consistently obtain the results desired from a steel investment casting. Berylco beryllium copper, on the other hand, reproduces minute detail (notice the serrations), permits sections as thin as 0.050", allows a tolerance of plus and minus 0.001" on the ¼" distance between hole centers.

The low pouring temperature and the fluidity of Berylco make it easier to handle than steel. Its excellent castability gives you smoother surfaces, cleaner holes and slots, more readily filled thin sections.

In addition to offering design and production advantages which result in lower costs, Berylco compares favorably in strength and wear resistance with medium carbon and stainless steels, has greater corrosion resistance and electrical conductivity. These are some of the reasons why more and more designers are specifying Berylco for precision investment cast parts.

The advantages of Berylco as an investment casting material are now being extensively advertised to designers. Take advantage of the trend. Send for your trial order today. Berylco is available in 5 lb., 2½ lb. and 3 oz. ingots.

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tion features of this die will be presented in the second part of this article.

A multiple-impression die was developed having 16 identical cavities arranged in two parallel lines, one each side of the sprue inlet of a center-sprue type die.

At each shot into the die, a gate of 16 plug castings is formed, connected by the runner.

The only further operations being required on castings after leaving the die consist of severing the runned and gate and sanding the largest diameter endface of each casting on an abrasive belt to remove gate-scar.

The die is also of the automatic type, in that the cores are mounted in slides operated by the normal opening and closing movements of the die halves.

It was found when this die was placed into regular casting production that an average of 180 shots per hour could easily be maintained, thus giving an hourly output of not less than 2,800 sealing plugs. This scale of production, incidentally, was one beyond the wildest expectations of the customer in view of his abortive experiences with other conventional methods.

Despite the use of 16 cavities in such a die the amortized costs to the customer was approximately equal to one eighteenth pence per unit plug casting.

This low tooling cost coupled with the complete elimination of machining, and absence of practically all alloy waste, since this could be re-melted for later casting, resulted in a final cost of only one tenth pence per sealing plug. This was a cost incomparably lower than any figure originally foreshadowed by the user as a result of his abortive attempts at producing the parts by other means.

ADVERTISERS' INDEX

AUGUST, 1953

A

Abbott Ball Co., The 61
Accurate Die Casting Co. 69
Acme Aluminum Foundry Co. 23
Advance Tool & Die Casting Co. 82
Aldrich Pump Co. 20
Allied Research Products, Inc. 50
Alloy Precision Castings Co. 7
Almco Div., Queen Stove Works, Inc. 52
Aluminum Industries, Inc. 2
Aluminum Permanent Mold Co. 85
Aluminum Smelting & Refining Co. Cover II
American Chemical Paint Co. 49
American Smelting & Refining Co. 18
American Zinc Sales Co. 10
Amplex Mfg. Co.
Subsidiary of Chrysler Corp. 13
Apex Smelting Co. ..... Cover IV

B

Badger Die Casting Corp. 87
R. N. Bailey & Co. 66
Bellows Company 54
Beryllium Corporation 86

C

Cannon-Muskegon Co. 72
Carborundum Co. 48
Cast-Master, Inc. 1
Central Die Casting & Mfg. Co., Inc. 72
Certified Alloys Co. ..... Cover II
Chemical Corporation 52
Chrysler Corporation, Amplex Division 13
Cleveland Hardware & Forging Co. 41
Crucible Steel Co. of America 11

D

Daniels Plating Barrel & Supply Co. 57
Detroit Electric Furnace Div.,
Kuhlman Electric Co. 67
Dollin Corporation 12
Dostal Foundry & Machine Co. 70

F

Federal Die Casting Co. 64
Fort Die Casting Co. 8

G

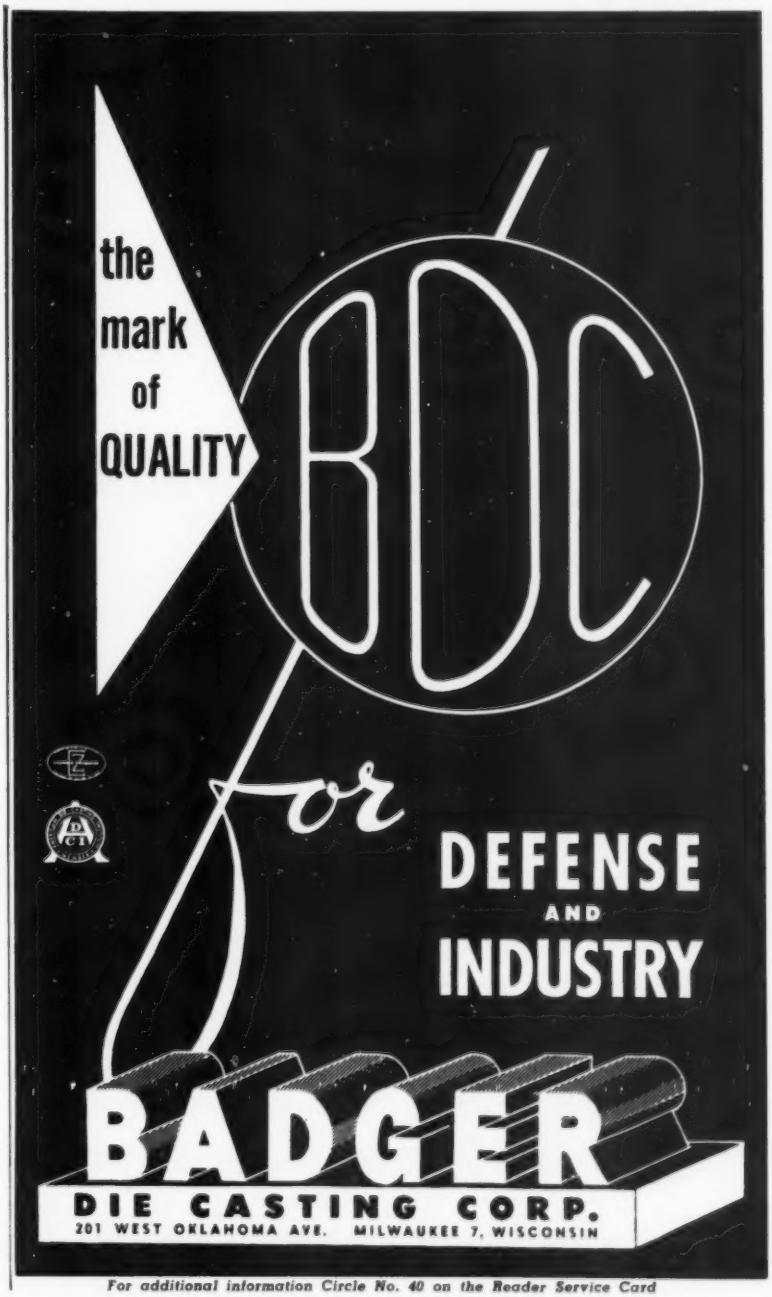
Gries Reproducer Corp. 76

H

Henning Bros. & Smith Inc. 79
Hitchiner Mfg. Co., Inc. 74
Hoeganaes Sponge Iron Co. 77
M. Holtzman Metal Co. 81
Hoover Company 15
Howard Foundry Co.,
Invesmena Casting Div. ..... Cover III

J

William F. Jobbins Co. 36



For additional information Circle No. 40 on the Reader Service Card

INDEX OF ADVERTISERS

continued from page 87

K

Kewanee-Ross Corp. 16
Kuhlman Electric Co. 67
Kux Machine Co. 35

L

Lewis Welding & Engineering Corp. 5
Litemetal Dicast, Inc. 66

M

Maas & Waldstein Co. 59
Madison-Kipp Co. 4
Magnetic Powders, Inc. 68
Malone Metal Powders 70
Mead Specialties Co. 56
Metal Hydrides, Inc. 62
Metals Disintegrating Co. 84
Milwaukee Die Casting Co. 79
Monsanto Chemical Co. 22
Moraine Products Div., General Motors Corp. 9
Mt. Vernon Die Casting Corp. 21

N

National Molded Products Co. 78
New England Die Casting Co. 74
New Holland Machine Co. 51
Newton-New Haven Co. 6

O

Oakite Products, Inc. 56
Ohio Precision Castings, Inc. 65

P

Paragon Die Casting Co. 80
Peerless Gear & Machine Co. 67
Parker White-Metal Co. 25
Permanent Mold Die Co., Inc. 14
Precision Castings Co., Inc. 19

R

Racine Die Casting Co. 74
Ransom & Randolph Co. 78
Republic Die Casting Co. 85

S

St. Joseph Lead Co. 24
Schultz Die Casting Co. 17
Scott Casting & Mfg. Corp. 67
Severance Tool Industries, Inc. 70
G. W. Smith & Sons, Inc. 75
Spincraft, Inc. 64
Sta-Warm Electric Co. 68
Standard Machinery Co. 85
Stroh Die Moulded Casting Co. 88
Summit-Roberts Tool Co. 65
Superior Die Casting Co. 71

T

Thompson Products Co., Light Metals Division 33
Thompson Products Co., Metallurgical Products Div. 26

U

Universal Die Casting Co. 83

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Engineers Design for "Lost Wax" Process...Gain More Design Freedom

One of the "parts" shown above is actually a wax pattern used to form an investment mold. Once a mold is put into a furnace, the wax is melted out, or "lost" Thus, the term "lost wax" investment casting process.

That's the process Howard Foundry's Investment Casting Division uses to mass-produce intricate shaped parts in hard-to-machine alloys, including both ferrous and non-ferrous metals.

The real part, in foreground, is made of alloy steel and is an eccentric rotor for a pneumatic hand tool. This as-cast part is a comparatively simple example of Howard's ability to cast parts too costly and difficult to manufacture any other way.

Compare the alloy steel part above with its wax pattern. Although you could detect the pattern from the cast part if it were on your desk (its green color and minute parting line would give it away), you would nonetheless admire the as-cast part's accuracy of detail. This as-cast accuracy gives you greater design freedom since you can have closer tolerances (±0.003" to ±0.008" per inch), smoother surfaces and even deep cast-in blind holes.

Each one of these Howard investment cast features means part-cost savings to you. But judge for yourself. Send a print of your part, samples, if possible, and give quantities desired. Our engineers will study your applications, then pass their recommendations along to you in a dollars and cents answer. There's no obligation.

"How Investment Casting Gives You New Design Freedom" is the title of the new eight-page booklet, which you may now order. Contains physical-property tables • Shows many applications • Answers your questions

WRITE TODAY on your business letterhead for Investment Castings by Howard – a 12-minute 16 mm. color sound film. Give date desired, an alternate date and size of group. Make film dates as far in advance as possible.

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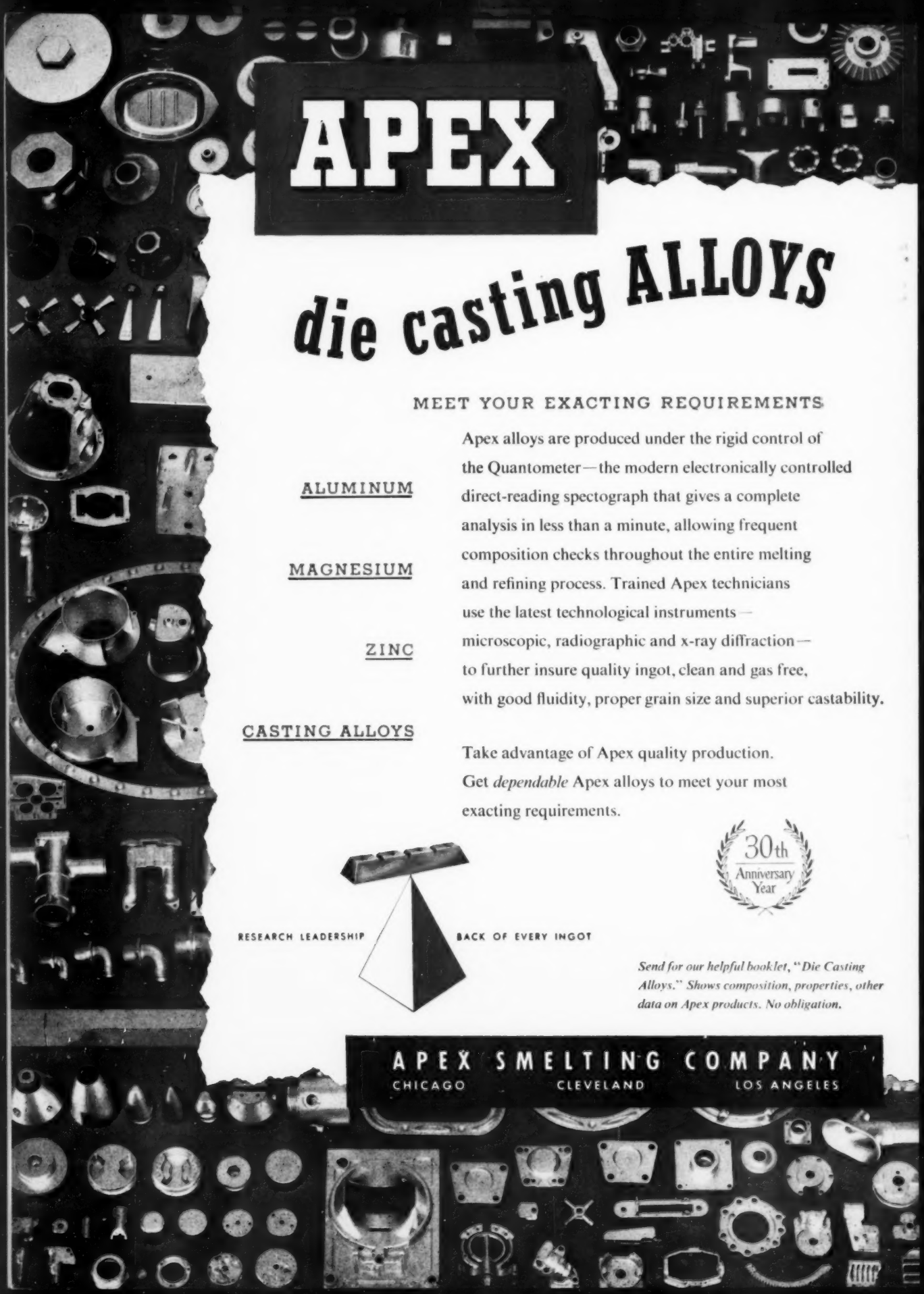

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